DEMONSTRATION RESULTS
OF
HOT GAS DECONTAMINATION
FOR EXPLOSIVES

at

HAWTHORNE ARMY DEPOT

Hawthorne Nevada 89415-0015

VOLUME IV OF IV

FINAL

Prepared for

U.S. ARMY ENVIRONMENTAL CENTER

Aberdeen Proving Ground, Maryland 21010-5401

Prepared by

THE TENNESSEE VALLEY AUTHORITY

ENVIRONMENTAL RESEARCH CENTER

Muscle Shoals, Alabama 35660-1010

SEPTEMBER 1995

DEPARTMENT OF THE ARMY
U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE (PROVISIONAL)
ABERDEEN PROVING GROUND, MARYLAND 21010-5422

REPLY TO ATTENTION OF

MCHB-ME-AP (1mm) 27 January 1995

MEMORANDUM FOR Commander, U.S. Army Material Command,
ATTN: AMCEN-A, 5001 Eisenhower Avenue,
Alexandria, VA 22333-0001

SUBJECT: Final Report, Hot Gas Decontamination System Compliance Test, Air Pollution Emission Assessment No. 42-21-MX61-95, Hawthorne Army Ammunition Plant, Hawthorne, Nevada, 17-29 October 1994.

Two copies of final report with Executive Summary are enclosed.

FOR THE COMMANDER:

Encl

DAVID L. DAUGHDRILL
Program Manager
Air Pollution Source Management

CF (w/encl):
HQDA(DAIM-ED)
USACPW, ATTN: CECPW-ES
CDR, AMCCOM, ATTN: AMCMS-SG
CDR, MEDCOM, ATTN: MCHO-CL-W
CDR, HWAAP, ATTN: SMCHW-OR (3 cy)
CDR, MAMC, ATTN: PVNTMED SVC (2 cy)
CDR, USAEC, ATTN: SFIM-AEC-TIC (2 cy)
CDR, DSA - W

USACHPPM

U.S. Army Center for Health Promotion and Preventive Medicine
(Provisional)

FINAL REPORT
AIR POLLUTION EMISSION ASSESSMENT NO. 42-21-MX61-95
HOT GAS DECONTAMINATION SYSTEM COMPLIANCE TEST
HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA
17-29 OCTOBER 1994

U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE (Provisional)

The U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) lineage can be traced back over fifty years to the Army Industrial Hygiene Laboratory. That organization was established at the beginning of World War II and was under the direct jurisdiction of The Army Surgeon General. It was originally located at the Johns Hopkins School of Hygiene and Public Health, with a staff of three and an annual budget not to exceed three thousand dollars. Its mission was to conduct occupational health surveys of Army operated industrial plants, arsenals, and depots. These surveys were aimed at identifying and eliminating occupational health hazards within the Department of Defense's (DOD) industrial production base and proved to be beneficial to the Nation's war effort.

Most recently, it has been nationally and internationally known as the U.S. Army Environmental Hygiene Agency or AEHA. Its mission, by this time, had been expanded to support the worldwide preventive medicine programs of the Army, DOD and other Federal Agencies through consultations/supportive services, investigations and training.

Today, it is redesignated the U.S. Army Center for Health Promotion and Preventive Medicine. Its mission for the future is to provide worldwide technical support for implementing preventive medicine, public health and health promotion/wellness services into all aspects of America's Army and the Army Community anticipating and rapidly responding to operational needs and adaptable to a changing world environment.

The professional disciplines represented at the Center include chemists, physicists, engineers, physicians, optometrists, audiologists, nurses, industrial hygienists, toxicologists, entomologists, and many others as well as sub-specialties within these professions.

The organization's quest has always been one of excellence and continuous quality improvement; and today its vision, to be the nationally recognized Center for Health Promotion and Preventive Medicine, is clearer than ever. To achieve that end, it holds ever fast to its values which are steeped in its rich heritage:

- Integrity is the foundation
- Excellence is the standard
- Customer satisfaction is the focus
- Its people are the most valued resource
- Continuous quality improvement is its pathway

Once again, the organization stands on the threshold of even greater challenges and responsibilities. It is being totally reorganized with a provisional structure and will obtain its first General Officer leadership. As it moves into the next century, new programs are being added related to health promotion/wellness, soldier fitness and disease surveillance. As always, its mission focus is centered upon the Army Imperatives so that we are trained and ready to enhance the Army's readiness for war and operations other than war.

It is an organization fiercely proud of its history, yet equally excited about the future. It is destined to continue it development as a world-class organization with expanded services to the Army, DOD, other Federal Agencies, the Nation and the World Community.

DEPARTMENT OF THE ARMY
U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE (PROVISIONAL)
ABERDEEN PROVING GROUND, MARYLAND 21010-5422

REPLY TO
ATTENTION OF

EXECUTIVE SUMMARY
FINAL REPORT
AIR POLLUTION EMISSION ASSESSMENT NO. 42-21-MX61-95
HOT GAS DECONTAMINATION SYSTEM COMPLIANCE TEST
HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA
17-29 OCTOBER 1994

1. PURPOSE. The purpose of this assessment was to determine air pollution emissions from the hot gas decontamination system, as tested. The results will be used by the State of Nevada Bureau of Air Quality to set operational and emissions limits.

2. CONCLUSIONS. Stack emissions data from the HGD system have been determined for total particulate matter, which includes particulate matter less than 10 microns in diameter, and certain air toxics. Testing for air toxics included carbon monoxide, nitrogen oxides, sulfur dioxide, total hydrocarbons, and the following metals; antimony, arsenic, barium, beryllium, cadmium, chromium, nickel, lead, silver, and thallium.

3. RECOMMENDATIONS. Provide a copy of this report to the State of Nevada Bureau of Air Quality.

Final Report, Air Pollution Emission Assessment No. 42-21-MX61-95, 17-29 October 1994

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TABLES

APPENDIX

MCHB-ME-AP

FINAL REPORT
AIR POLLUTION EMISSION ASSESSMENT NO. 42-21-MX61-95
HOT GAS DECONTAMINATION SYSTEM COMPLIANCE TEST
HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA
17-29 OCTOBER 1994

1. REFERENCES. See Appendix A for a listing of references.

2. AUTHORITY. AEHA Form 250-R, USAEC, 9 June 1993.

3. PURPOSE. The purpose of this assessment was to determine emissions from the hot gas decontaminations (HGD) system, as tested. The results will be used by the State of Nevada Bureau of Air Quality to set operational and emissions limits.

4. GENERAL.

a. Background. The U.S. Army Environmental Center (USAEC) is investigating technologies to effectively treat explosives-contaminated components. Pilot studies have shown that decontamination of structural components is possible using a heated gas to thermally decompose or volatilize explosives with subsequent incineration in a thermal oxidizer (references 3 and 4). The pilot study conducted at HWAAP from 10 July to 21 September 1989 concluded that the HGD system is effective for treating items contaminated with TNT and ammonium picrate (reference 4). A second pilot study, from 20 June to 31 October 1994, was conducted to determine if the HGD system would successfully decontaminate items contaminated with explosives; COMP A-3, COMP B, HBX, H-6, RDX, TNT, and Yellow D (reference 5). Stack gas testing was conducted during 17-29 October to support HWAAP permitting requirements.

b. Operating Requirements.

(1) Batch Feed Rate. The HGD chamber was to be loaded between 90% and 100% (22.5 tons and 25 tons, respectively) of capacity with explosive-contaminated items for this assessment. The HGD system runs as a batch process, such that one configuration of contaminated items is loaded, brought up to temperature, decontaminated, cooled and removed, and then repeated with another configuration of items.

(2) Test Item. Sampling was conducted to determine the stack emissions of the HGD system when decontaminating 175mm projectiles contaminated with COMP B. The 175mm projectiles are considered the worst-case items to be tested in the HGD system based on the decomposition temperature of the TNT fraction, and the potential for elevated CO, NO_x, and THC emissions. The COMP B 60-40 mixture of RDX and TNT, respectively, is the highest formulation of both compounds. The TNT has the highest explosion temperature, 1058°F, of the proposed explosives to be decontaminated (reference 6). TNT has the highest carbon content among all explosives and theoretically requires the longest residence time in the thermal oxidizer for complete combustion. Based on this criteria, TNT was determined to have the greatest potential to generate maximum THC and CO emissions. The RDX fraction has the highest nitrogen content for the explosives of concern, therefore, potentially causing elevated NO_x emissions during operations.

c. Emission Standards. Stack sampling was conducted during the operation of the HGD system to assess air pollutant emissions. The State of Nevada Bureau of Air Quality required testing for particulate matter less than 10 microns in diameter (PM_{10}), and certain air toxics. Testing for air toxics included carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), total hydrocarbons (THC), and the following metals; antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), chromium (Cr), nickel (Ni), lead (Pb), silver (Ag), and thallium (Tl) (reference 7). Table 1 summarizes the U.S. Environmental Protection Agency (EPA) approved reference methods, equipment, and procedures used in this assessment (reference 8).

d. Sampling Location.

(1) The HGD system exhausts to a 54-inch inside diameter (ID) refractory-lined stack that also serves as the thermal oxidizer. Two 6-inch ID ports, located at right angles to each other, are located 111-inches (2.1 duct diameters) upstream and

TABLE 1. SAMPLING METHODS SUMMARY

POLLUTANT	SAMPLING METHOD
PM_{10}	Method 202* / RM 5†
Metals	Multiple Metals Method‡
CO	RM 10†
NO_x	RM 7E†
SO_2	RM 6C†
THC	RM 25A†

* Reference 9
† Reference 8
‡ Reference 10

129-inches (2.4 duct diameters) downstream from the nearest flow disturbances (the wind dam and the thermal oxidizer burners, respectively). The number of traverse points required per the EPA reference method 1 (RM 1) of reference 7 is 24. The traverse point locations within the stack are shown in Appendix B. A preliminary velocity traverse and cyclonic flow check was performed and the flow was proven to be acceptable. Velocity and cyclonic flow data can be found in Appendix B.

(2) A 1/4-inch stainless steel line was inserted 45 degrees from and 19 inches above the 6-inch sampling ports to remove a sample stream of gas to be analyzed by the THC, NO_x, CO, and SO_2 continuous emission monitor system (CEMS).

e. Sampling Time Summary. Testing was conducted during four batch process runs of the HGD system, test series 31 through 34. The PM_{10} sampling train was operated within the first 10 hours of operation and conincided with the time when propellent was flashing off of the 175mm projectiles. The metals sampling train was operated during the last 6 hours of treatment so that sampling wasconducted when the metal was at its maximum temperature in the chamber. The CEMS was operated during each test run, twice during each batch process.

f. Sampling Equipment and Procedures. A description of the metals and PM_{10} sampling apparatus and procedures can be found in Appendix C.

g. Sample Recovery and Analysis. A description of the metals and PM_{10} sample recovery and analysis procedures can be found in Appendix D.

h. Calibration Procedures. A summary of calibration procedures and calibration data for the sampling train and the ORSAT analyzer can be found in Appendix E.

i. Continuous Emission Monitoring. A description of the THC, NO_x, CO, and SO_2 monitors can be found in Appendix F.

j. Nonstandard Events.

(1) Process Feed Rate. For all test runs the actual configuration was a total weight of 26.7 tons which was above the specified 25 tons initially specified (reference 11).

(2) PM_{10} Train Sampling Duration. The PM_{10} train sampling duration was reduced to 2 hours to decrease the potential of equipment failure in the high temperature stack. This also ensured that sampling was conducted during the period that propellent was flashing off projectiles to lessen the likelihood of sample dilution.

(3) Metals Train Sampling Duration. The metals train sampling duration was increased to 72 minutes to ensure that a minimum sample volume of 30 cubic feet could be drawn from the stack.

(4) Water-Cooled Probe. The water-cooled probe had developed a hole at the thermocouple weld during testing conducted on 19 Ocotober 1994. Steam was being generated in the probe as it began to heat. The test was postponed for safety concerns until the next morning when a new probe assembly could be configured.

(5) Run 1. The method 202 train failed the intermediate leak check. An additional batch process was scheduled so that particulate sampling could be conducted during the period when propellent was flashing off the projectiles. Data from the CEMS, however, is still considered valid. The average stack gas flow rate from the remaining runs was used to estimate emission rates from the CEMS data.

(6) THC Monitor. The THC monitor had a flame failure during the majority of run 3 therefore no data could be generated. Although the monitor calibrated withhin the requirments, the avg THC reading during run 4 was below zero, thus the data is not reported.

(7) NO_x Monitor. Data from run 4 is not reported because the monitor could not show linearity during the post calibration. Data from runs 6 and 7 was not reported because there was no mid-range calibration gas remaining to check the linearity of the NO_x monitor.

(8) CO Monitor. The CO emission data for runs 1, 2, 3 and 5 is not reported because the monitor did not show linearity during the pre or post calibrations.

(9) SO_2 Monitor. The SO_2 emission data for run 5 was not reported because the monitor could not show linearity during the post calibration. During run 7, moisture built up in the sample line before the SO_2 monitor and caused SO_2 to be removed from the sample gas, thus, the SO_2 monitor data from run 7 was not reported.

(10) PM_{10} Sample Analysis. During the analysis of the back half water fraction of the PM_{10} train, the samples were inadvertently discarded. Therefore, no final weights are recorded for the inorganic condensible particulate matter (CPM), method 202 back half, portion of the PM_{10} train.

k. Nomenclature and Equations. The nomenclature and equations used for this assessment are found in Appendix G.

l. Assessment Personnel. Personnel that were in involved in the assessment are listed in Appendix H.

5. FINDINGS AND DISCUSSION

a. Sampling Train Data Summary. Field data sheets, isokinetic computation sheets, and detailed summaries of all sampling train runs are provided in Appendix I.

b. Process Operation Data Summary. The charge load rate for each test run was 26.7 tons which was above the 25 ton limit pre-established in the test protocol. A summary of the average process operation data is given in Table 2 for each batch process tested (reference 12). Graphs showing the heatup of certain projectilesin the HGD chamber can be found in Appendix J for each batch process

TABLE 2. PROCESS WASTE FEED AND AVERAGE OPERATING CONDITIONS

Dates		TEST* SERIES 31 20-21 Oct	TEST SERIES 32 23-24 Oct	TEST SERIES 33 26-27 Oct	TEST SERIES 34 29-30 Oct
FEED DATA					
Average Batch Feed					
175mm COMP B Proj	(No.)	480	480	480	480
	(lb/ea)	115	115	115	115
	(tons)†	27.6	27.6	27.6	27.6
Operational Data					
Total Batch Process Time (hr)		27.75	30.75	32	28.5
HGD Chamber Target Process Temp (°F)		550	550	550	550
Total Heatup Time To Process Temp (hr)		18.75	18.5	18	17.5
Treatment Time At Target Process Temp (hr)		6	6	6	6
Thermal Oxidizer Set Temp (°F)		1800	1800	1800	1800
Thermal Oxidizer +/- Limit (°F)		50	50	50	50
Average Thermal Oxidizer Temp (°F)		1798	1804	1805	1797
Thermal Oxidizer #2 Fuel Oil Rate	(gal/hr)	28.16	27.87	28.19	28.03
	(lbs/hr)	205.71	203.57	205.94	204.78
	(MBTU/hr)	3.995	3.953	3.999	3.977
Average Stack Temp (°F)		1667	1781	1794	1768
Avg Stack Pressure (in Hg)		*	26.4	26.13	26.2
Avg Stack Gas Velocity (ft/sec)		*	21.61	19.38	21.05

* Test Run 1 - PM_{10} train failed intermediate leak check.
† Batch feed rate exceeds previous limit of 25 tons.

(reference 13). Graphs of CEM data for exhaust gases exiting the HGD chamber can be found in Appendix K for each batch process (reference 13).

c. Emission Performance. As required, a minimum of three valid runs of data were collected to assess PM_{10}, THC, NO_x, CO, SO_2 and metals emissions form the HGD system. A summary of the average emission rates for all valid test runs for the 175mm COMP B contaminated projectiles is provided in Table 3. A summary of the average emission rates for each run is provided in Tables 4 and 5.

(1) PM_{10} Emissions. The average PM_{10} emission rate was found to be 1.238 tons/year (based on 8760 hours of operation/year). The emission rate of PM_{10} ranged from 0.605 to 1.592 tons/year. The water sample, method 202 back half portion, from the PM_{10} train was inadvertently discarded; therefore, the PM_{10} results do not include the inorganic fraction of CPM. Detailed PM_{10} sampling data can be found in Appendix L.

(2) CEM Calibration Data. Calibration of the THC, NO_x, CO and SO_2 CEM's was done each day before and after each test run. Calibration was done using EPA protocol-1 gases. Monitor response had to be within the respective reference method requirements. Detailed CEM calibration data is provided in Appendix M.

(3) THC Emissions. The average THC emission rate was found to be 0.023 ton/year (based on 8760 hours of operation/year). The emission rate of THC ranged from 0.008 to 0.048 tons/year. Detailed THC sampling data can be found in Appendix N.

(4) NO_x Emissions. The average NO_x emission rate was found to be 16.31 tons/yr (based on 8760 hours of operation/year). The emission rate of NO_x ranged from 8.58 to 22.04 tons/year. Detailed NO_x sampling data can be found in Appendix O.

(5) CO Emissions. The average CO emission rate was found to be 0.64 ton/year (based on 8760 hours of operation/year). The emission rate of CO ranged from 0.54 to 0.76 tons/year. Detailed CO sampling data can be found in Appendix P.

(6) SO_2 Emissions. The average SO_2 emission rate was found to be 10.62 tons/yr (based on 8760 hours of operation/year). The emission rate of SO_2 ranged from 7.79 to 11.92 tons/year. Detailed SO_2 sampling data can be found in Appendix Q.

TABLE 3. SUMMARY OF HGD SYSTEM AVERAGE EMISSIONS

DATE		HWAAP HGD TEST 17-29 Oct 1994
FEED DATA		
Batch Feed per Test		
175mm COMP B Proj	(No.)	480
	(lb/ea)	115
	(tons)*	27.6
EMISSION DATA		
Avg PM_{10} Emission†		
Rate	(lb/hr)	0.283
	(tons/yr)	1.238
Avg THC Emission		
Rate	(lb/hr)	0.005
	(tons/yr)	0.023
Avg NO_x Emission		
Rate	(lb/hr)	3.72
	(tons/yr)	16.31
Avg CO Emission		
Rate	(lb/hr)	0.15
	(tons/yr)	0.64
Avg SO_2 Emission		
Rate	(lb/hr)	2.43
	(tons/yr)	10.62
Avg Metals Emission		
Rate	(g/hr)	
Ag		0.00494
As		0.00350
Ba		0.02994
Be		0.00031
Cd		0.02829
Cr		0.14378
Ni		0.22324
Pb		0.06069
Sb		0.00119
Se		0.00063
Tl		0.00043

* Batch feed rate exceeds previous limit of 25 tons.
† Water fraction inadvertently discarded during inorganic CPM analysis.

TABLE 4. SUMMARY OF HGD SYSTEM AVERAGE EMISSION DURING EACH METALS TEST

DATE		RUN 2 10/21/94	RUN 4 10/24/94	RUN 6 10/27/94
FEED DATA				
Average Batch Feed				
175mm COMP B Proj	(No.)	480	480	480
	(lb/ea)	115	115	115
	(tons)*	27.6	27.6	27.6
EMISSION DATA				
Avg THC Emission				
Rate	(lb/hr)	0.002	†	0.009
	(tons/yr)	0.008	†	0.040
Avg NO_x Emission				
Rate	(lb/hr)	1.96	†	†
	(tons/yr)	8.58	†	†
Avg CO Emission				
Rate	(lb/hr)	†	0.12	0.14
	(tons/yr)	†	0.54	0.63
Avg SO_2 Emission				
Rate	(lb/hr)	2.52	2.40	1.78
	(tons/yr)	11.05	10.52	7.79
Avg Metals Emission				
Rate	(g/hr)			
Ag		0.00146	0.00062	0.01272
As		0.00772	0.00192	0.00085
Ba		0.03398	0.03972	0.01611
Be		0.00036	0.00030	0.00029
Cd		0.05378	0.02240	0.00869
Cr		0.04243	0.24067	0.14823
Ni		0.04441	0.42284	0.20247
Pb		0.07737	0.07593	0.02878
Sb		0.00229	0.00090	0.00038
Se		0.00071	0.00060	0.00057
Tl		0.00071	0.00030	0.00029

* Batch feed rate exceeds previous limit of 25 tons.
† Monitor not within calibration requirements.

TABLE 5. SUMMARY OF HGD SYSTEM AVERAGE EMISSIONS DURING EACH PM_{10} TEST

DATE		RUN 1* 10/20/94	RUN 3 10/23/94	RUN 5 10/26/94	RUN 7 10/29/94
FEED DATA					
Average Batch Feed 175mm COMP B Proj	(No.)	480	480	480	480
	(lb/ea)	115	115	115	115
	(tons)†	27.6	27.6	27.6	27.6
EMISSION DATA					
PM_{10} Emission Rate‡	(lb/hr)	*	0.346	0.138	0.363
	(tons/yr)	*	1.517	0.605	1.592
Avg THC Emission Rate	(lb/hr)	0.001	♦	0.011	0.004
	(tons/yr)	0.002	♦	0.048	0.018
Avg NO_x Emission Rate	(lb/hr)	3.63	4.27	5.03	♦
	(tons/yr)	15.91	18.72	22.04	♦
Avg CO Emission Rate	(lb/hr)	♦	♦	♦	0.17
	(tons/yr)	♦	♦	♦	0.76
Avg SO_2 Emission Rate	(lb/hr)	2.70	2.72	♦	♦
	(tons/yr)	11.84	11.92	♦	♦

* PM_{10} train failed intermediate leak check.
† Batch feed rate exceeds previous limit of 25 tons.
‡ Water fraction inadvertently discarded during inorganic CPM analysis.
♦ Monitor not within calibration requirements.

(7) CEMS Graphs. Graphs showing the concentrations of THC, NO_x, CO and SO_2, emitted during each test run can be found in Appendix R. The 1 minute average CEMS concentration response for THC, NO_x, CO, amd SO_2, for all test runs, can also be found in Appendix R.

(8) Metals Emissions. Emissions for the 11 metals that were sampled for at the HGD system have been determined. The 11 metals sampled were picked for their health hazard characteristics based on the RCRA standards for hazardous waste incinerators (HWI's)(reference 14). Detailed metals sampling data can be found in Appendix S.

d. Sampling and Analysis Results.

(1) Methods Summary. A summary of the sampling procedures used in this assessment is summarized in Table 1.

(2) Stack Gas Data. A summary of stack gas data can be found in Appendix I.

e. Sampling/Analysis Quality Assurance.

(1) QA Objectives. Quality assurance objectives for the trains operated in this assessment are detailed in Appendix D.

(2) Sampling Procedures. Quality assurance for emission sampling consisted primarily of performing necessary calibrations per references 15 and 16. In addition, stack sampling equipment was operated as per reference 17. EPA Protocol-1 gases were used to calibrate the CEMS. Appendix E contains a summary of calibration data.

(3) Data Completeness. Data was collected to make a complete assessment of the THC, NO_x, CO, SO_2, and metals emissions from the HGD system. The back half water condensible particulate matter portion of the PM_{10} train was inadvertently discarded. Therefore the PM_{10} data reflects the sum of the organic fraction of the CPM and the particulate collected in the method 5 portion of the PM_{10} train.

6. CONCLUSIONS.

a. Air Toxics Emissions. As required, a minimum of three valid test runs were obtained for PM_{10}, THC, NO_x, CO, SO_2, and metals to determine their respective emissions. The PM_{10} emissions were determined using the total front half particulate and the back half organic CPM. The water sample to determine the inorganic fractionof the CPM was inadvertently discarded during analysis, therefore the inorganic CPM was not included in the results.

b. THC Emissions. THC emissions were monitored to reflect the efficiency of the thermal oxidizer. The concentration of the THC in the chamber exhaust duct before the thermal oxidizer spiked up to 100 ppm during test 31. But the thermal oxidizer THC concentration never went above 1.10 ppm during all valid THC sampled test runs. This illustrates that the thermal oxidizer is effectively treating the effluent leaving the HGD chamber by destroying the organics that were thermally removed from the projectiles.

c. Metals Emissions. The metals emissions have not been compared to any standard since the HGD system metal emissions are not RCRA regulated.

d. Operating Requirements. Normal operations during this testing exceeded the pre-established 25 tons as reflected in the test protocol. Operational data logs recorded during each batch process will be provided upon request if this data is required to set permit operating conditions.

7. RECOMMENDATIONS.

a. Provide a copy of this report to the State of Nevada Bureau of Air Quality.

b. Based on the results of testing, consider adjusting the limit of material loaded per batch process to reflect the 26.7 tons of COMP B projectiles treated during each test of the HGD system.

8. TECHNICAL ASSISTANCE. Requests for assistance should be directed through appropriate command channels of the requesting activity to the Commander, U.S. Center for Health Promotion and Preventive Medicine (PROV), ATTN: MCHB-ME-AS, Aberdeen Proving Ground, MD 21010-5422, with an information copy furnished to the Commander, U.S. Army Medical Command, ATTN: MCHO-CL-W, 2050 Worth Rd., Fort Sam Houston, TX 78234-6000.

JOHN T. LITYNKSI
Environmental Engineer
Air Pollution Source Management Program

APPROVED:

DAVID L. DAUGHDRILL
Program Manager
Air Pollution Source Management

APPENDIX A

REFERENCES

1. AR 40-5, 30 August 1986, Preventive Medicine.

2. AR 200-1, 15 June 1982, Environmental Protection and Enhancement.

3. Arthur D. Little, Inc., Pilot Plant Testing of Caustic Spray/Hot Gas Building Decontamination Process, prepared for USATHAMA (Task Order Number 5). USATHAMA Reference AMXTH-TE-CR-87112, August 1987.

4. Roy F. Weston, Inc., Pilot Test of Hot Gas Decontamination of Explosives-Contaminated equipment at Hawthorne Army Ammunition Plant, prepared for USATHAMA (Task Order Number 2). USATHAMA Report No. CETHA-TE-CR-90036, June 1990.

5. The Tennessee Valley Authority Environmental Research Center, Test Plan for Development and Demonstration of Hot Gas Decontamination for Explosives at Hawthorne Army Ammunition Plant, prepared for USAEC (AEC Form Number 45). USAEC Report No. SFIM-AEC-TS-CR-94027, May 1994.

6. U.S. Army Material Command, Engineering Design Handbook - Explosives Series Properties of Explosives of Military Interest, USAMC Document No. AMCP 706-177, January 1971.

7. Telephone conversation between John T. Litynski, this office, and Mark Kvan, State of Nevada Bureau of Air Quality, 30 August 1994, subject: Testing Requirements for Air Toxics at HWAAP.

8. Title 40, Code of Federal Regulations (CFR), 1993 rev, Part 60, Standards of Performance for New Stationary Sources, Appendix A, Reference Methods.

9. Title 40, CFR, 1993 rev, Part 51, Requirements for Preparation, Adoption, and Submittal of Implementation Plans.

10. RCRA Regulations and Keyword Index, Appendix IX, Part 266, Methods Manual for Compliance with the BIF Regulations, McCoy and Associates, Inc., 1992 Edition.

11. U.S. Army Center for Health Promotion and Preventive Medicine (Provisional), Test Protocol, Air Pollution Emission Assessment No. 42-21-MX61-94, Hot Gas Decontamination System Compliance Test, 8 September 1994.

Final Report, Air Pollution Emission Assessment No. 42-21-MX61-95, 17-29 October 1994

12. The Day and Zimmermann/Basil Corporation, Process operation logs recorded during HGD of COMP B contaminated 175mm projectiles, Testing Conducted: 17 through 29 October 1994.

13. The Tennessee Valley Authority Environmental Research Center, CEM and Temperature data logs recorded during HGD of COMP B contaminated 175mm projectiles, Testing conducted: 17 through 29 October 1994.

14. RCRA Regulations and Keyword Index, Appendix I, Part 266, Methods Manual for Compliance with the BIF Regulations, McCoy and Associates, Inc., 1992 Edition.

15. EPA Manual APTD-0576, March 1982, Maintenance, Calibration, and Operation of Isokinetic Source Sampling Equipment.

16. EPA Manual No. 600/4-77/027b, March 1983, Quality Assurance Handbook for Air Pollution Measurement Systems, Vol II, Stationary Source Specific Methods.

17. Title 40, CFR, 1992 Rev, Part 60, Standards of Performance for New Stationary Sources.

18. EPA Manual SW-846, November 1986, Test Methods for Evaluating Solid Waste, Third Edition: Volume IA: Laboratory Manual Physical/Chemical Methods.

APPENDIX B

VELOCITY TRAVERSE AND CYCLONIC FLOW DATA

TRAVERSE POINT LOCATION FOR CIRCULAR STACKS

INSTALLATION: HWAAP

DATE: 10-18-94

SAMPLING LOCATION: HGD Systems

INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE (DISTANCE A): 64 1/2"

INSIDE OF NEAR WALL TO OUTSIDE OUTSIDE OF NIPPLE (DISTANCE B): 10"

STACK I.D. (A - B): 54"

NEAREST UPSTREAM DISTURBANCE: 129"

NEAREST DOWNSTREAM DISTURBANCE: 111'

SCHEMATIC OF SAMPLING LOCATION

PITOT TUBE BLOCKAGE CORRECTION FACTOR:

3.2%

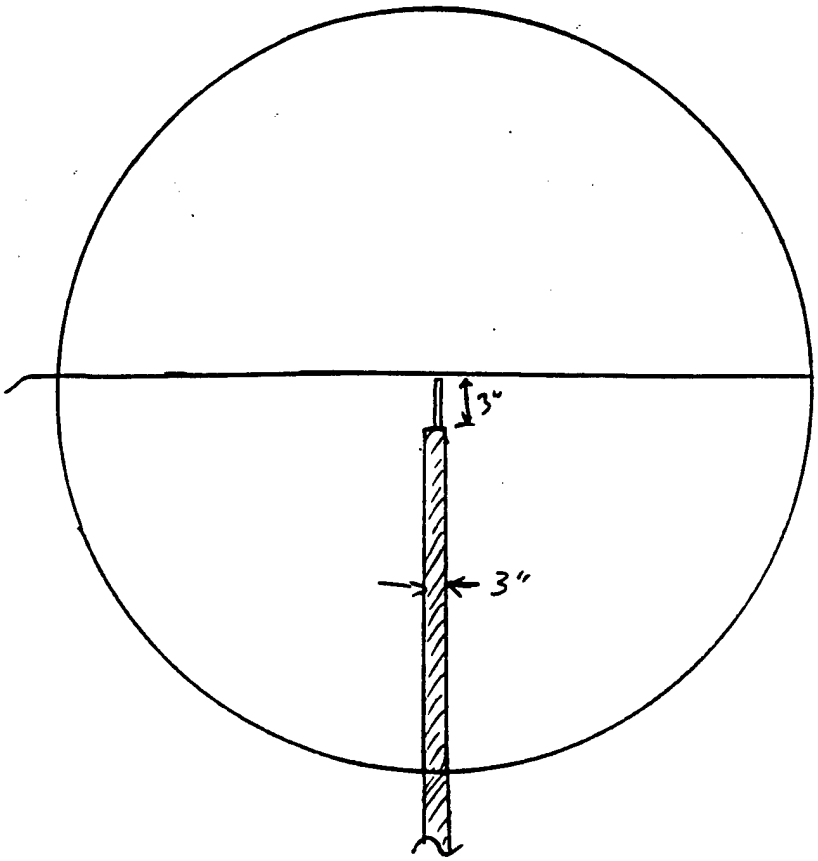
External Sheath and % Blockage > 3% K = 1.0197 - 0.0098 (% Blockage) = .9869

No External Sheath and % Blockage > 2% K = 1.0132 - 0.0101 (% Blockage)

% Blockage = (Stack Dia/2 - Nozzle Length)(Sheath Dia)/Stack Area X 100

$C_{P_{corr}}$ = 0.84 K Cp_{Train} = ~~0.827~~ 0.831

Traverse Point Number	Fraction of Stack ID	Stack ID	Traverse Point Location (To Nearest 1/8")	Distance B	Traverse Point Location From Outside Nipple
1	2.1	54"	1 1/4	10"	11 1/4
2	6.7		3 5/8		13 5/8
3	11.8		6 3/8		16 3/8
4	17.7		9 1/2		19 1/2
5	25.0		13 1/2		23 1/2
6	35.6		19 1/4		29 1/4
7	84.4		34 3/4		44 3/4
8	75.0		40 1/2		50 1/2
9	82.3		44 3/8		54 3/8
10	88.2		47 5/8		57 5/8
11	93.3		50 3/8		60 3/8
12	97.9	↓	52 7/8	↓	62 7/8



% Blockage = [(stack dia/2 - nozzle length)(sheath dia)/stack area]x100

= [(54"/2 - 3")(3")/π(54)²/4] x 100

= 3.14%

∴ K = 1.0197 - (.0098)(3.14)

K = .9889

$C_{p(std)} = 0.831_{B-3}$

STACK GAS VELOCITY AND CYCLONIC FLOW DATA

INSTALLATION	DATE
Hawthorne Army Ammunition Plant	10-18-94

SAMPLING LOCATION	CLOCK TIME
Hot Gas Decontamination System	

OPERATOR	AMBIENT TEMP (°F)	BAROMERTRIC PRESSURE (in. Hg)	STATIC PRESSURE (in. H_2O)
	62		

MOLECULAR WEIGHT (lb/lb mole)	EXHAUST STACK ID (in.)		PITOT TUBE C_p
	DIA OR SIDE 1	SIDE 2	
29.0	54"	54"	0.84

TRAVERSE POINT NUMBER		POSITION (in.)	STACK GAS VELOCITY HEAD δ (in. H_2O) E		STACK TEMPERATURE (°F)		YAW ANGLE (degrees)	
1	13	11 1/4	.013		1718		11	
2	14	13 5/8	.018		1779		10	
3	15	16 3/4	.018		1795		12	
4	16	19 1/2	.025		1796		16	
5	17	23 1/2	.040		1814		13	
6	18	29 1/4	.055		1821		11	
7	19	44 3/4	.045		1796		11	
8	20	50 1/2	.025		1782		08	
9	21	54 3/4	.02		1770		07	
10	22	57 5/8	.013		1761		14	
11	23	60 3/8	.015		1752		13	
12	24	62 7/8	.015		1748		11	
Average			0.025		1778		11.4	

APPENDIX C

SAMPLING EQUIPMENT AND PROCEDURES

APPENDIX C

SAMPLING EQUIPMENT AND PROCEDURES

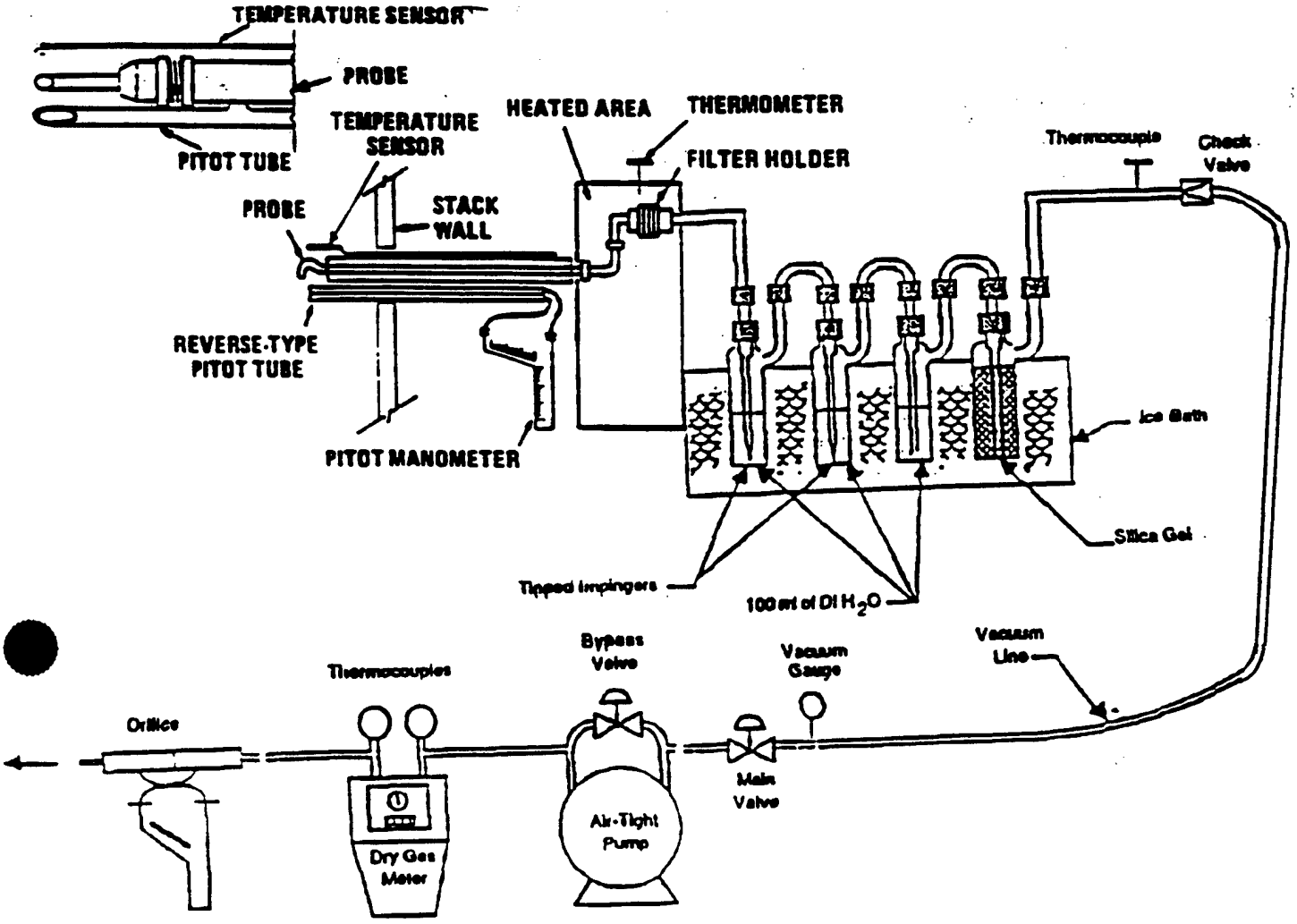
1. STACK SAMPLING. Due to the different types of emissions that were measured, two different trains and four different continuous emission monitors were used. PM_{10} emissions were measured using the U.S. Environmental Protection Agency (EPA) approved method 202 with a reference method 5 front half assembly. Metals emission were measured using the EPA recommended mutiple metals train (MMe)(reference 9). A description of the CEMs is located in Appendix F.

a. Particulate/PM_{10} Train. The PM_{10} and particulate matter was collected using a modified method 202 sampling train with the following exception. As per reference 9, an alternative method to directly measuring PM_{10} (method 201) is to perform the front half of a reference method 5 and the back half of a method 202 train. The temperature exiting the HGD stack was in excess of 1600°F; therefore, an out of stack filter is required. All collected particulate matter was considered as PM_{10}. All collected particulate matter included the probe wash, filter catch, front half rinse, back half rinse (condensible organics), and the impingers' catch (condensible organics). The PM_{10} train, as shown in Figure C-1, was configured as follows:

Quartz sampling nozzle
Quartz-lined, water-cooled sampling probe
Cyclone eliminator
4-inch filter with glass housing
90-degree glass elbow
Impinger No. 1 - Greenburg-Smith Design - 100 mL D/D H_2O
180-degree glass connector
Impinger No. 2 - Greenburg-Smith Design - 100 mL D/D H_2O
180-degree glass connector
Impinger No. 3 - 100 mL DI H_2O
180-degree glass connector
Impinger No. 4 - silica gel

b. Metals Train. Metals emission samples were collected using the multiple metals sampling train specified in reference 10. This train (MeM5), as shown in Figure C-2, was configured as follows:

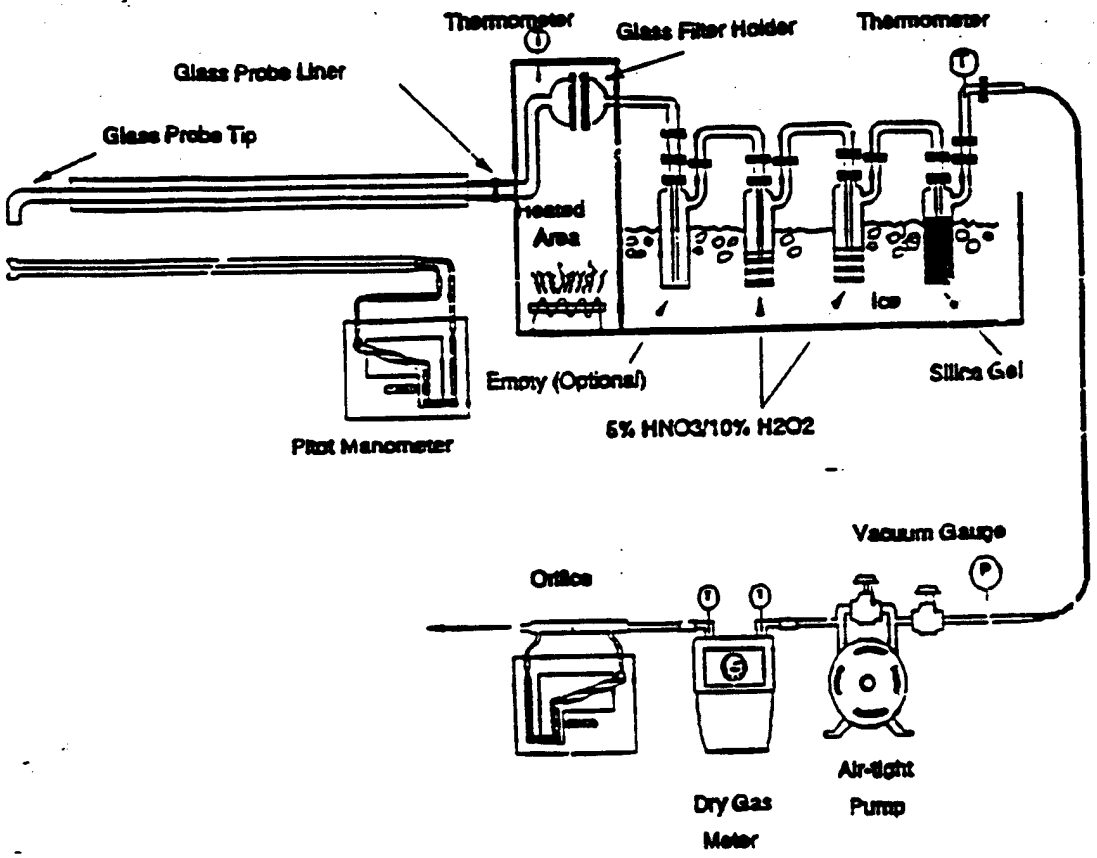
Quartz sampling nozzle
Quartz-lined, water-cooled sampling probe
Cyclone eliminator
4-inch filter with glass housing
90-degree glass elbow
Impinger No. 1 - dry
180-degree glass connector
Impinger No. 2 - 100 mL of 5% Nitric Acid (HNO_3)
and 10% hydrogen peroxide (H_2O_2) solution
180-degree glass connector



Impinger Contents

Impinger 1 - 100 mL DD H_2O
Impinger 2 - 100 mL DD H_2O
Impinger 3 - 100 mL DD H_2O
Impinger 4 - silica gel

FIGURE C-1. SCHEMATIC OF PM_{10} SAMPLING TRAIN (RM5 AND METHOD 202)



Impinger Contents

Impinger 1 - dry
Impinger 2 - 100 mL HNO_3/H_2O_2
Impinger 3 - 100 mL HNO_3/H_2O_2
Impinger 4 - silica gel

FIGURE C-2. MULTIPLE METALS TRAIN

Impinger No. 3 - Greenburg-Smith Design - 100 mL of 5% (HNO_3) and 10% (H_2O_2) solution
180-degree glass connector
Impinger No. 4 - silica gel

The following train description is common to both the PM_{10} and MeM5 sampling trains. The water-cooled sampling probe uses a heated Quartz liner. The S-type pitot tubes and thermocouples were attached to the sampling probe. The pitot tubes are 0.75-inch from the probe nozzles, and the thermocouples were placed so as to eliminate any disturbance in the velocity measurements. The probe was attached to a sample box containing a particulate filter which was connected to the impinger train. The PM_{10} filter was tared while the MeM5 filter was not tared. The glass filter was enclosed in a chamber heated to 248 ± 25 °F. The impingers were packed in an ice bath to cool the gas and remove moisture from the gas sample. The sample box was connected to an umbilical cord that contains the vacuum line, pitot lines, electrical connections, and thermocouple wires. The meter box has a calibrated dry gas meter, a calibrated orifice, and a vacuum pump that draws the sample through the sampling equipment. Two manometers, mounted on the meter box, measured the velocity pressure in the stack and the pressure differential across the meter box orifice.

2. STACK SAMPLING TECHNIQUE. All sampling trains were operated isokinetically. Isokinetic sampling was performed by controlling the sampling flow rates so the velocity of the gas entering the sampling nozzle was within 10% of the undisturbed stack gas stream velocity at each sample point. The stack gas velocity was monitored by an S-type pitot tube while stack gas temperature was determined by a thermocouple assembly. An integrated gas sample was taken per RM 3 of reference 8 at a constant rate using a sampling tube attached to the probe assembly, a vacuum pump, and a Teflon® collection bag.

3. TEST POINTS. The number of sample points per traverse was determined per EPA RM 1. A total of 24 traverse points (12 per traverse) was required. Figure C-3 indicates the locations within the stack.

4. STACK GAS MOISTURE. The stack gas moisture was determined by EPA RM 4. Moisture was collected during each train in the impingers. All impingers were kept in an ice bath so that the temperature of the gas leaving the final impinger did not exceed 68°F. Each impinger was then weighed before and after each run on a top loading scale, accurate to 0.1 gram.

5. STACK GAS COMPOSITION. The stack gases were sampled according to EPA RM 3 to determine CO_2, CO, and O_2 concentrations via ORSAT.

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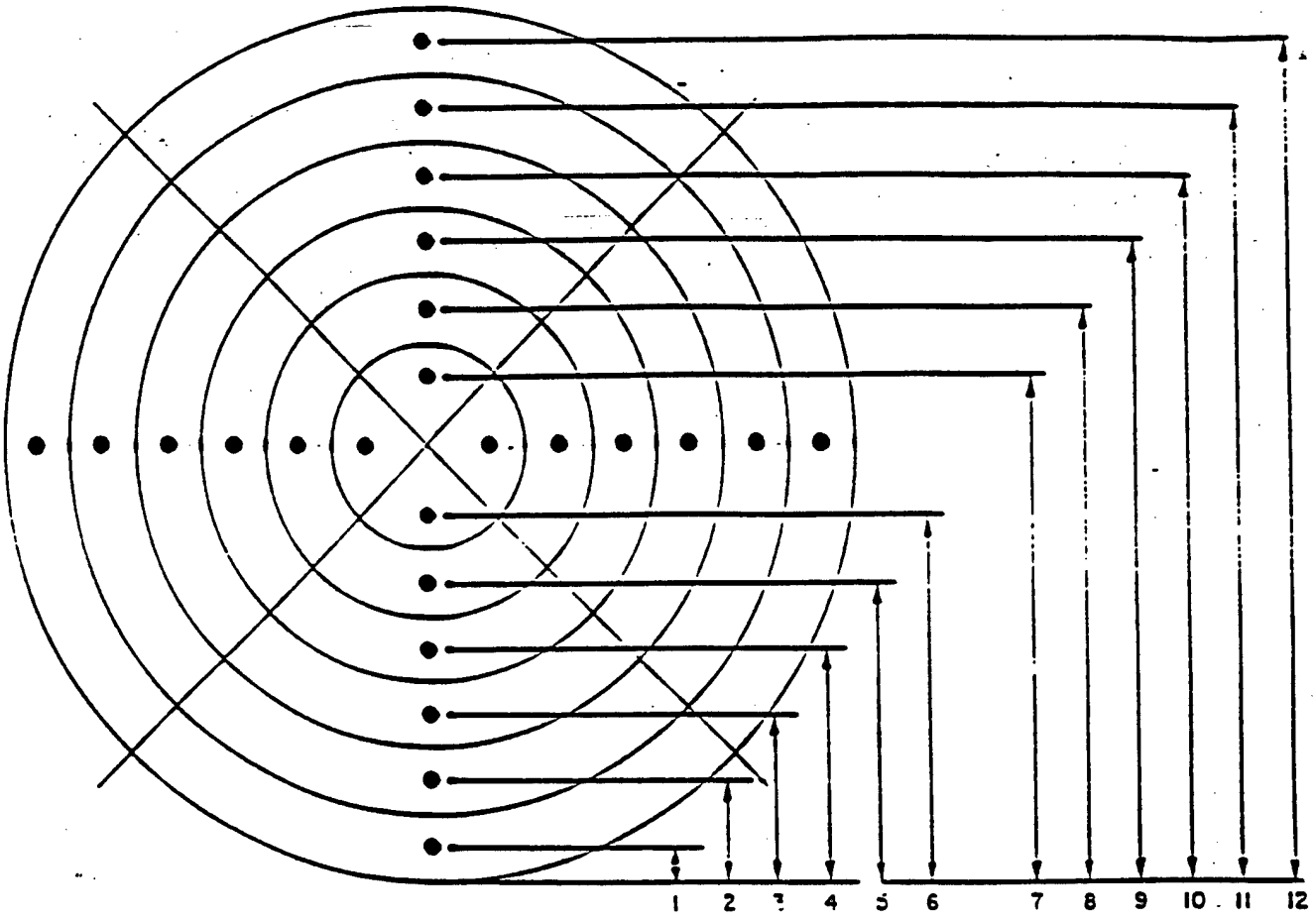


Point No.	Percentage of Stack Diameter	Distance From Stack Wall
1,13	2.1	1 1/4"
2,14	6.7	3 5/8"
3,15	11.8	6 3/8"
4,16	17.7	9 1/2"
5,17	25.0	13 1/2"
6,18	35.6	19 1/4"
7,19	64.4	34 3/4"
8,20	75.0	40 1/2"
9,21	82.3	44 3/8"
10,22	88.2	47 5/8"
11,23	93.3	50 3/8"
12,24	97.9	52 7/8"

FIGURE C-3. TRAVERSE POINTS WITHIN 54-INCH INSIDE-DIAMETER STACK

APPENDIX D

SAMPLE RECOVERY AND ANALYSIS

APPENDIX D

SAMPLE RECOVERY AND ANALYSIS

1. PM_{10} NITROGEN PURGE. After each PM_{10} train was completed the pH of the first impinger solution was less than 4.5, therefore, a nitrogen (N_2) purge to remove SO_2 was conducted. The probe and filter was detached from the impinger train, and the impinger train was left in the ice bath to maintain the gas temperature below 20°C. The N_2 gas fitting was attached to the inlet of the impinger train as shown in Figure D-1. The N_2 flow and the meter box pump valve were opened simultaneously to avoid over- or under-pressurizing the train. The N_2 purge was conducted for 1 hour with a flow rate of 20 L/min through the impinger train (reference 9).

2. SAMPLE RECOVERY.

a. PM_{10}/Particulate Train Samples. The sample recovery for the PM_{10} train is as follows (reference 9):

(1) All impingers were weighed and the results recorded for moisture determination.

(2) Sample 1 (Filter): The filter was removed from the filter holder and placed in a petri dish. Any particulate matter or filter fibers that adhered to the filter gasket were transferred to the petri dish. The labeled petri dish was then sealed.

(3) Sample 2 (Front-Half Acetone Rinse): The probe and nozzle were rinsed with acetone followed by scrubbing with a probe brush after the probe was allowed to cool. The probe wash was collected in a sample container. The front half of the sampling train was also rinsed with acetone and combined with the probe wash in the sample container. The sample container was then sealed and labeled.

(4) Sample 3 (Impinger Contents): The liquid was then measured in the first three impingers by weighing it to within 0.5 g using a balance. This liquid was quantitatively transfered into a clean glass sample bottle; the connecting glassware and each impinger was rinsed twice with water, and the rinse water was added to the same sample bottle. The liquid level was then marked on the bottle.

(5) Sample 4 [Methylene Chloride ($MeCl_2$) Rinse]: Following the water rinses of each impinger and the connecting glassware (including probe extension), an additional two rinses of $MeCl_2$ was performed; the rinse products were saved in a clean, glass sample jar. The liquid level of the jar was then marked and the sample sealed.

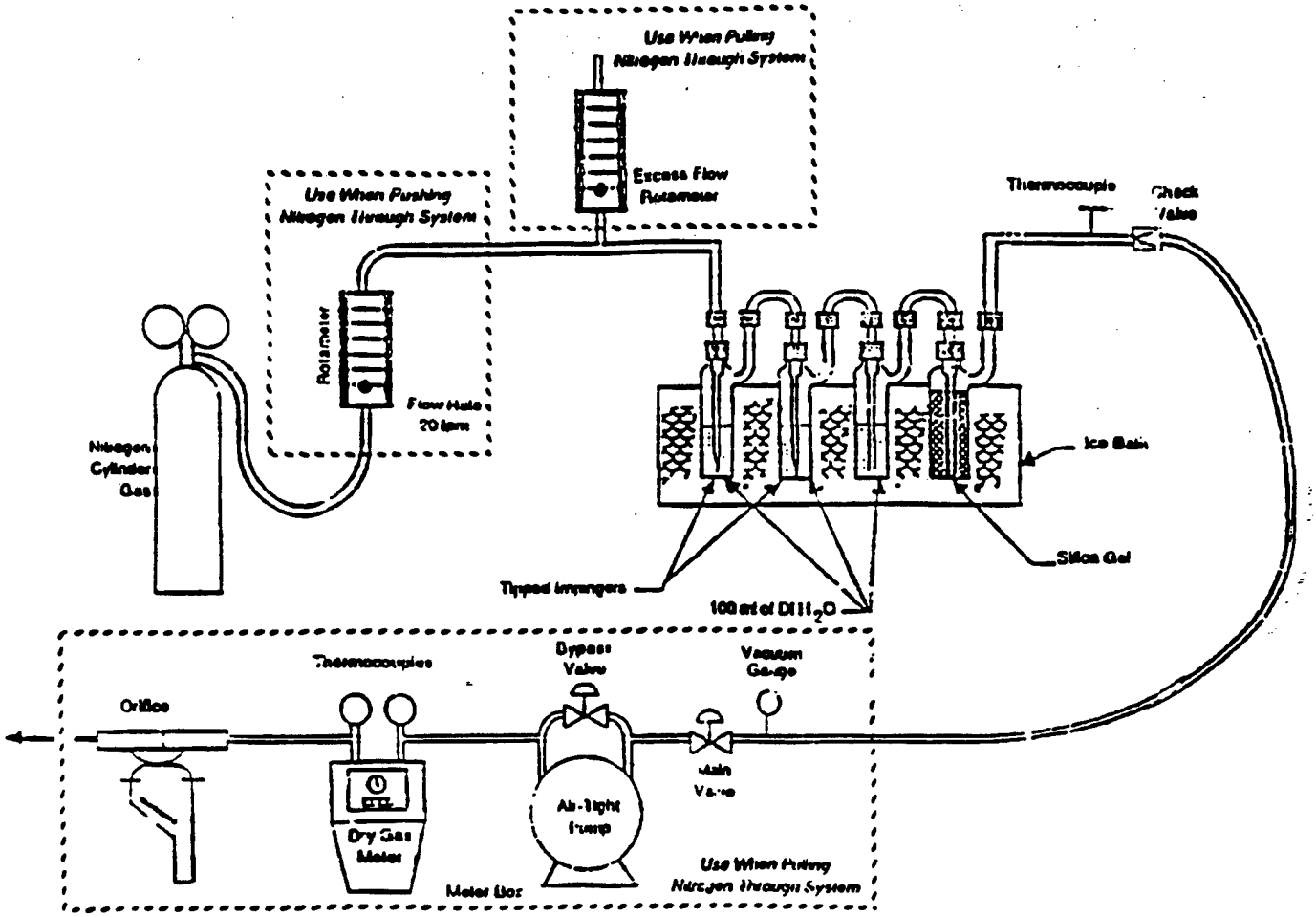


FIGURE D-1. SCHEMATIC OF PM_{10} POST-TEST NITROGEN PURGE

b. MeM5 Train Samples. The sample recovery for the MeM5 train consisted of the following steps (reference 10):

(1) All impingers were weighed and the results recorded for moisture determination.(2) Sample No. 1 (Filter): The filter from the filter holder was placed in its identified petri dish. Any particulate matter or filter fibers that adhered to the filter gasket were transferred to the petri dish. The labeled petri dish was then sealed.

(3) Sample No. 2 (Front-Half Rinse): The nozzle, probe, and front half of the filter holder were rinsed and scrubbed with 100 mL of 0.1 N HNO_3. The rinses were collected into a sample container.

(4) Sample No. 3 (Impingers 1 through 3, HNO_3/H_2O_2 Impingers Contents and Rinses): The contents of impingers 1 through 3 were combined into a graduated cylinder, and the volume was measured and recorded to within 0.5 mL. The liquid was then transferred into a sample container. After rinsing each impinger, the connecting glassware and the back half of the filter housing with 100 mL of 0.1 N HNO_3, the rinses were combined with the impinger contents. The sample container was sealed and labeled for anaysis.

3. SAMPLE ANALYSIS.

a. Train Sample Analysis. The analytical procedures used to analyze the train samples generated during this test are summarized in Table D-1.

(1) Particulate. The filter was desiccated and weighed to a constant weight. The acetone probe wash and front half rinse were transferred into a tared beaker and evaporated to dryness. The total front half particulate weight was determined by adding the probe wash residue to the weight gained by the filter, less the acetone blank correction. The back half water rinse (including impinger 1-3 contents) was combined with the back half $MeCl_2$ rinse and transferred into a separatory funnel. The $MeCl_2$/organic phase was then separated and drained off into a graduated cylinder. Two additional 75-mL $MeCl_2$ organic extractions were performed on the combined sample. The organic particulate fraction was determined by transferring the extractions into a tared weighing tin and placing it into a laboratory hood to evaporate the solvent to dryness. The water portion of the extration for the inorganic particulate determination for the back half was inadvertantly discarded during analysis. The back half particulate weight was determined by accounting for only the organic CPM less the correction for the $MeCl_2$ blank. The total particulate weight was determined by adding the front half particulate weight and the back

TABLE D-1. ANALYTICAL PROCEDURES SUMMARY

COMPONENT	PARAMETER	TECHNIQUE	ANALYSIS METHOD
Particulate/PM_{10}			
Impingers	Moisture	Gravimetric	RM 4*
Acetone Probe Wash	Particulate	Gravimetric	RM 5*
Filter	Particulate	Gravimetric	RM 5*
Back Half Rinse	Particulate	Gravimetric	Method 202*
MeM5			
Impingers	Moisture	Gravimetric	RM 4*
Acid Probe Wash	Metals	ICAP/AAS	MeM5†
Filter	Metals	ICAP/AAS	MeM5†
Impinger 1-3	Metals	ICAP/AAS	MeM5†

* Reference 9
† Reference 10

half particulate weight. All weights were determined on an analytical balance accurate to 0.01 mg.

(2) Metals. All train samples were prepared and analyzed per reference 10. The analysis for all target metals were done either by inductively-coupled argon plasma spectroscopy (ICAP) (Method 6010 of reference 18) or by Atomic Absorption Spectroscopy (AAS) methods. If AAS was used, either the direct aspiration or the graphite furnace method was used.

APPENDIX E

SAMPLING EQUIPMENT CALIBRATION DATA

APPENDIX E

SAMPLING EQUIPMENT CALIBRATION DATA

1. QA/QC PROCEDURES. The QA/QC calibration procedures for the sampling equipment are those specified in applicable methods. In general, they consisted of pretest and posttest calibrations of sampling equipment.

2. CALIBRATION OF SAMPLING EQUIPMENT. Calibration of all sampling equipment was performed prior to and immediately following the test using the procedures outlined in reference 15 and 16. Calibrations of the probe nozzles, pitot tube alignment, dry gas meters, thermometers, and thermocouple/pyrometer assemblies were conducted. Additionally, the USACHPPM routinely participates in the EPA national QA audits for dry gas meters and ORSAT combustion gas analyzers. Table E-1 summarizes these equipment calibration methods.

TABLE E-1. CALIBRATION PROCEDURES SUMMARY

DEVICE	METHOD/STANDARD	REFERENCE
Meter Box Orifice	Wet Test Meter	APTD-0576*
Dry Gas Meter	Wet Test Meter	APTD-0576*
Pyrometer	NBS Reference Pyrometer	EPA RM 5†
Pitot Tube	Geometry	EPA RM 2†
Thermometer/ Thermocouple	Reference Pyrometer	EPA RM 2†
Nozzle	Micrometer	EPA RM 5†
Orsat Analyzer	Calibration Gases	EPA-600/4-77-027b‡

* Reference 15
† Reference 8
‡ Reference 16

3. CALIBRATION DATA. Pre and post calibration data sheets for equipment used during the HGD system assessment are included in the following pages.

PITOT NUMBER: WC-5-1
INSPECTOR: Th Thompson
DATE: 30 Oct 84 RUN:
INSTALLATION:

PITOT - NOZZLE - THERMOCOUPLE - PROBE CONFIGURATION

1. External Tubing Diameter, D_e (3/16" to 3/8")	3/8"
2. Base of Pitot to Opening Plane Distance, Impact, P_A (1.05 to 1.5D_e) .3938-.5625	.559
Static, P_B (1.05 to 1.5D_e)	.559
3. Angle between plane of impact face of pitot tube and transverse tube axis, α_1 (<10°)	40
4. Angle between plane of static pitot tube face and transverse tube axis, α_2 (<10°)	50
5. Angle between plane of impact pitot tube face and longitudinal axis, β_1 (< ± 5°)	1°
6. Angle between plane of static pitot tube face and longitudinal axis, β_2 (< ± 5°)	0.0°
7. Distance between leading tip of the impact and static tubes, Z (< 1/8") $\gamma = 0°$ $A = 1.118$	.03
8. Distance between the transverse axes for the impact and static pitot faces, w (< 1/32") $\theta = 0°$ $A \geq 1.118$	.019
9. Pitot - Nozzle Separation, x (> 3/4")	
10. Pitot plane above nozzle entry (yes)	yes
11. Nozzle type (button hook)	yes
12. Distance between thermocouple and pitot, z (> 3/4")	
13. Distance between tangent to thermocouple body and centerline of impact opening, y (>3")	
14. Distance between gas line and centerline of impact opening, Z (>2")	
15. Distance between sample probe ferrule and centerline of impact opening, Y (>3")	Y =

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Annual Calibration

Meter box number 2928

Date 23 Aug 94

Barometric pressure, P_b = 30.080 in. Hg Calibrated by Dawn C. Bremer

Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperatures: wet test meter (t_w), °F	Temperatures: Dry gas meter: Inlet (t_{d_i}), °F	Temperatures: Dry gas meter: Outlet (t_{d_o}), °F	Temperatures: Dry gas meter: Avg (t_d), °F	Time (θ), min	Y_i	$\Delta H@_i$, in. H_2O
0.5	5	5.126	75.5	94	87	90.5	12.33	1.002	1.67
1.0	5	5.110	75.5	94	87	90.5	8.87	1.003	1.73
1.5	10	10.210	75.5	94	87	90.5	15.00	1.003	1.85
2.0	10	10.222	75.5	96	88	92	13.02	1.004	1.86
3.0	10	10.217	75.5	96	89	92.5	10.78	1.002	1.91
4.0	10	10.224	75.5	97	89	93	9.27	1.000	1.88
							Avg	1.002	1.82

Vacuum 3 in. Hg

$\frac{\Delta H}{in.\ H_2O}$	$\frac{\Delta H}{13.6}$
0.5	0.0368
1.0	0.0735
1.5	0.110
2.0	0.147
3.0	0.221
4.0	0.294

$$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$$

$$\Delta H@_i = \frac{0.0317\ \Delta H}{P_b\ (t_d + 460)} \left[\frac{(t_w + 460)\ \theta}{V_w} \right]^2$$

Meter Box

Front Half Leak Check OK

Back Half Leak Check OK

Vacuum Gauge Check OK

Thermometer Check (±3°F of ASTM Hg) In OK Out OK

Wet Test Meter

Meter No. 11AH8

Capacity 1 CF/REV

Calibration Date 30 NOV 93

Leak Check OK

Water Level Check OK

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d.

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Post - Calibration

Date 10 NOV 94 Meter box number 292B

Barometric pressure, P_b = 30.12 in. Hg Calibrated by Dawn Bruner

Orifice manometer setting (ΔH), in. H_2O	Gas volume: wet test meter (V_w), ft^3	Gas volume: dry gas meter (V_d), ft^3	Temperatures: wet test meter (t_w), °F	Temperatures: dry gas meter inlet (t_{d_i}), °F	Temperatures: dry gas meter outlet (t_{d_o}), °F	Temperatures: dry gas meter AVG (t_d), °F	Time (θ), min	Y_i	$\Delta H@_i$, in. H_2O
1.10	5.0	5.051	75	91	84	87.5	8.55	1.010	1.77
1.10	5.0	5.053	75	91	84	87.5	8.56	1.010	1.77
1.10	5.0	5.057	75	91	84	87.5	8.56	1.009	1.77
							Avg	1.010	1.77

Vacuum 6.8 in. Hg

$\frac{\Delta H}{13.6}$	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	$\Delta H@_i = \frac{0.0317\ \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\ \theta}{V_w} \right]^2$
1.10	.0809	Meter Box	Wet Test Meter
		Front Half Leak Check OK	Meter No. 11AH8
		Back Half Leak Check OK	Capacity 1C.F/REV
		Vacuum Gauge Check OK	Calibration Date 30NOV94
		Thermometer Check (ΔT of t_d) In 012 Out OK	Leak Check OK
			Water Level Check OK

[2] If there is only one thermometer on the dry gas meter, record the temperature under t_d.

APPENDIX F

CONTINUOUS EMISSION MONITOR SYSTEMS

APPENDIX F

CONTINUOUS EMISSION MONITOR SYSTEMS

1. DESCRIPTION. The following continuous monitors were used to measure CO, NO_x, SO_2, and THC emissions. The results were continuously recorded at 1-minute intervals by a data logger. Calibration gas certification sheets are included in this appendix.

a. CO Monitor. A Beckman Nondispersive Infrared (NDIR) Analyzer was used to monitor the CO concentration in the stack gases. The analysis is based on the differential measurement of the absorption of infrared energy. The CEM was operated per RM 10 of reference 8. Calibration gases are admitted to the monitoring system tubing at the stack sampling point. The system is calibrated against EPA Protocol 1- certified gases per RM 10. Certified gases with the following concentrations were used:

(1) High Span - 85.05 ppm CO/N_2

(2) Zero Gas - Prepurified N_2

(3) Low Span - 25 ppm CO/N_2

(4) Mid Span - 46.03 ppm CO/N_2

b. NO_x Monitor. A Thermo Environmental Chemiluminescent Analyzer was used to monitor the NO_x concentration in the stack gases. NO_2 is converted to nitric oxide (NO) in a heated stainless steel chamber. The analysis is based on the reaction of NO with ozone (O_3). A photomultiplier tube records light emitted as the NO converts to NO_2, which has a lower energy level. The CEM was operated per RM 7E of reference 8. Calibration gases were admitted to the monitoring system tubing at the stack sampling point. The system was calibrated against certified gases per RM 7E. EPA Protocol 1-certified gases with the following concentrations were used:

(1) Zero Gas - Prepurified N_2

(2) Mid-Range Gas - 137.3 ppm NO/N_2

(3) High-Range Gas - 225.8 ppm NO/N_2

c. SO_2 MONITOR. A Western Research Model 721AT Ultraviolet SO_2 Analyzer was used to monitor the SO_2 concentration in the stack gases. The monitor is based on a single source emitting the appropriate wavelengths. The radiation beam moves across the gas sample, is split, and passes through two separate filters. Each

beam of radiation is detected by a highly sensitive photomultiplier tube providing the primary signal in the calculation of the SO_2 concentration. The CEM was operated per RM 6C of reference 8. Calibration gases were admitted to the monitoring system tubing at the stack sampling point. The system was calibrated against certified gases per RM 6C. EPA Protocol 1-certified gases with the following concentrations were used:

(1) Zero Gas - Prepurified N_2

(2) Mid-Range Gas - 84.48 ppm SO_2/N_2

(3) High-Range Gas - 149.1 ppm SO_2/N_2

d. THC Monitor. A Teledyne Model 402R Total Hydrocarbon Analyzer was used to monitor the volatile organic compounds as total nonmethane hydrocarbons. This monitor is a flame ionization detector. The THC concentration is measured by the electrical conduction between two electrodes formed when a regulated flow of sample gas passes through a flame sustained by regulated flows of a fuel gas and air. The sample collection, calibration, and measurement was done in accordance with RM 25A of reference 8. The gas sample was extracted from the stack, passed through a heated filter and condensing system, and pumped to the analyzer. The system was calibrated before and after each sampling run. As per RM 25A, EPA Protocol 1-certified gases with the following concentrations were used:

(1) Zero Gas - Hydrocarbon Free Air

(2) FID Fuel - 40% H_2/60% N_2

(3) High Span - 53.8 ppm Propane/N_2

(4) Mid Span - 24.88 ppm Propane/N_2

(5) Low Span - 8.05 ppm Propane/N_2

2. CONDENSING SYSTEM. The moisture removal system was identical to that used for the RM 5 train. The sample gas passed through a fiberglass filter in the heated compartment of a sample box and four short stem dry impingers. All impingers were cooled in an ice bath to remove moisture from the gas sample stream.

Scott Specialty Gases, Inc.

1290 COMBERMERE STREET, TROY, MI 48083 (313) 589-2950 FAX: (313) 589-2134

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
C A E INSTRUMENT RENTAL
246 WOODWORK LANE
PALATINE IL 60067-2495

Assay Laboratory
Scott Specialty Gases, Inc.
1290 Combermere
Troy, MI 48083

Purchase Order 9691-71500
Scott Project # 557395

ANALYTICAL INFORMATION

Certified to exceed the minimum specifications of EPA Protocol 1 Procedure #G1, Section Number 3.0.4

Cylinder Number AAL3021
Cylinder Pressure 1900 psig

Certification Date 11-10-93
Previous Certification Dates None

Expiration Date = 11-10-96

ANALYZED CYLINDER Components	Certified Concentration	Analytical Uncertainty*
Carbon Monoxide	25.00 ppm	±1% NIST Directly Traceabl

Balance Gas: Nitrogen

*Analytical uncertainty is inclusive of usual known error sources which at least includes reference standard error & precision of the measurement processes.

REFERENCE STANDARD Type	Expiration Date	Cylinder Number	Concentration
CRM 1678	5-12-94	AAL6302	45.76 PPM IN N_2

INSTRUMENTATION Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
CO: Beckman/867/0100157	8-23-93	Non-Dispersive Infrared

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components: Carbon Monoxide

First Triad Analysis

Date: 11-2-93 Response Units: mv

Z1=0.00	R1=46.80	T1=25.80
R2=46.80	Z2=0.00	T2=25.80
Z3=0.00	T3=25.80	R3=46.80

Avg. Conc. of Cert. Cyl. 25.00 ppm

Second Triad Analysis

Date: 11-10-93 Response Units: mv

Z1=0.00	R1=46.80	T1=25.80
R2=46.80	Z2=0.00	T2=25.80
Z3=0.00	T3=25.80	R3=46.80

Avg. Conc. of Cert. Cyl. 25.00 ppm

Calibration Curve

Concentration=A+Bx+Cx²+Dx³+Ex

r=0.99999	CRM 1678
Constants:	A=0.3465483
B=0.9339077	C=0.0009539
D=-0.000003327	E=0 —

Concentration=A+Bx+Cx²+Dx³+E:

Concentration=A+Bx+Cx²+Dx³+E

Special Notes

Analyst Frank P. Doran

Scott Specialty Gases, Inc.
1290 COMBERMERE STREET, TROY, MI 48083 (810) 589-2950 FAX:(810) 589-2134

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
C A E INSTRUMENT RENTAL
246 WOODWORK LANE
PALATINE, IL 60067

Assay Laboratory
Scott Specialty Gases, Inc
1290 Combermere
Troy, MI 48083

Purchase Order : 11072-71500
Scott Project # : 564384

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay and Certification of Gaseous Calibration Standards; Procedure G1; September, 1993.

Cylinder Number : ALM010511
Cylinder Pressure + : 1900 psig

Certificate Date : 4/20/94
Previous Certificate Date : None

Expiration Date : 4/20/97

ANALYZED CYLINDER Component	Certified Concentration	Analytical Uncertainty*
Carbon Monoxide	46.83 ppm	±1% NIST Directly Traceable –

Balance Gas: Nitrogen

+Do not use when cylinder pressure is below 150 psig.
*Analytical accuracy is inclusive of known error sources which at least include precision of the measurement processes.

REFERENCE STANDARD Type	Expiration Date	Cylinder Number	Concentration
SRM 2631A	6/22/97	ALM-024840	96.21 ppm Carbon Monoxide in Nitrogen

INSTRUMENTATION Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
CO : Beckman/864/102528	4/23/94	Non-Dispersive Infrared

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components
Carbon Monoxide

First Triad Analysis

Date: 4/13/94 Response Units: mv

Z1=0.00	R1=80.00	T1=38.40
R2=80.00	Z2=0.00	T2=38.40
Z3=0.00	T3=38.60	R3=80.00

Avg. Conc. of Cust. Cyl. 46.15 ppm

Second Triad Analysis

Date: 4/20/94 Response Units: mv

Z1=0.00	R1=80.00	T1=38.20
R2=80.00	Z2=0.00	T2=38.70
Z3=0.00	T3=38.30	R3=80.00

Avg. Conc. of Cust. Cyl: 46.90 ppm

Calibration Curve

Concentration=A+Bx+Cx^2+Dx^3+Ex^4

r=1.00000	STM 2631A
Comments:	A=0.000000000
B=1.203500000	C=0.000000000
D=0.000000000	E=0.000000000

Special Notes

Rhonda Lundy

Analyst Rhonda Lundy

Scott Specialty Gases, Inc.

1290 COMBERMERE STREET, TROY, MI 48083 (313) 589-2950 FAX: (313) 589-2134

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
CAE INSTRUMENT RENTAL
246 WOODWORK LANE
PALATINE, IL, 60067-5000

Assay Laboratory
Scott Specialty Gases, Inc.
1290 Combermere
Troy, MI 48083

Purchase Order 10084-71
Scott Project # 559264

ANALYTICAL INFORMATION

Certified to exceed the minimum specifications of EPA Protocol 1 Procedure #G1, Section Number 3.0.4

Cylinder Number ALM028214
Cylinder Pressure 1900 psig

Certification Date 12-14-93
Previous Certification Dates None

Expiration Date 12-14-9

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Carbon Monoxide	85.05 ppm	±1% NIST Directly Traceat

Balance Gas: Nitrogen

*Analytical uncertainty is inclusive of usual known error sources which at least includes reference standard error & precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
CRM 1679A	6-22-97	ALM024840	96.21 PPM CO IN N_2

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
CO: Beckman/867/0100157	11-10-93	Non-Dispersive Infrared

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components: Carbon Monoxide

First Triad Analysis

Date: 12-6-93 Response Units: mv
Z1=0.00 R1=96.40 T1=85.50
R2=96.40 Z2=0.00 T2=85.50
Z3=0.00 T3=85.50 R3=96.40
Avg. Conc. of Cust. Cyl. 85.05 ppm

Second Triad Analysis

Date: 12-14-93 Response Units: mv
Z1=0.00 R1=96.40 T1=85.50
R2=96.40 Z2=0.00 T2=85.50
Z3=0.00 T3=85.50 R3=96.40
Avg. Conc. of Cust. Cyl. 85.05 ppm

Calibration Curve

Concentration=A+Bx+Cx²+Dx³+Ex⁴
r=0.99999 CRM 1679A
Concentration: A=0.3465483
B=0.9139077 C=0.00095399
D=0.000003327 E=0

Concentration=A+Bx+Cx²+Dx³+Ex⁴

Concentration=A+Bx+Cx²+Dx³+Ex⁴

Special Notes

Analyst Tim Sanderson

Scott Specialty Gases, Inc.
1290 COMBERMERE STREET, TROY, MI 48083 (313) 589-2950 FAX: (313) 589-2134

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
C A E INSTRUMENT RENTAL
246 WOODWORK LANE
PALATINE IL 60067-5000

Assay Laboratory
Scott Specialty Gases, Inc.
1290 Combermere
Troy, MI 48083

Purchase Order 10084-71500
Scott Project # 559264

ANALYTICAL INFORMATION

Certified to exceed the minimum specifications of EPA Protocol 1 Procedure #G1, Section Number 3.0.4

Cylinder Number AAL5168
Cylinder Pressure 1900 psig
Certification Date 12-13-93
Previous Certification Dates None
Expiration Date - 12-13-95

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Nitric Oxide	137.3 ppm	±1% NIST Directly Traceable
Total Oxides of Nitrogen	137.6 ppm	Reference Value Only

Balance Gas: Nitrogen

*Analytical uncertainty is inclusive of usual known error sources which at least includes reference standard error & precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
NTRM 1685	11-19-94	ALM-024062	244.7 ppm NO in N_2

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
NO: Beckman/951/0101177	11-10-93	Chemiluminescence

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components
Nitric Oxide

First Triad Analysis

Date: 12-6-93 Response Units: mv
Z1=0.00 R1=100.0 T1=56.20
R2=100.0 Z2=0.00 T2=56.20
Z3=0.00 T3=56.20 R3=100.0
Avg. Conc. of Cust. Cyl. 137.6 ppm

Second Triad Analysis

Date: 12-13-93 Response Units: mv
Z1=0.00 R1=100.0 T1=56.00
R2=100.0 Z2=0.00 T2=56.00
Z3=0.00 T3=56.00 R3=100.0
Avg. Conc. of Cust. Cyl. 137.1 ppm

Calibration Curve

Concentration=A+Bx+Cx²+Dx³+Ex⁴
r=0.99999 NTRM 1685
Constants: A=0.2631951
B=2.444368 C=0
D=0 E=0

Concentration=A+Bx+Cx²+Dx³+Ex⁴

Concentration=A+Bx+Cx²+Dx³+Ex⁴

Special Notes

Analyst Frank P. Doran

Scott Specialty Gases, Inc.

1290 COMBERMERE STREET, TROY, MI 48083 (810) 589-2950 FAX:(810) 589-2134

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
C A E INSTRUMENT RENTAL
246 WOODWORK LANE
PALATINE, IL 60067

Assay Laboratory
Scott Specialty Gases, Inc
1290 Combermere
Troy, MI 48083

Purchase Order : 12153-71500
Scott Project # : 571378

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay and Certification of Gaseous Calibration Standards: Procedure G1; September, 1993.

Cylinder Number : ALM047786
Cylinder Pressure + : 1900 psig

Certificate Date : 10/6/94
Previous Certificate Date : None

Expiration Date : 10/6/96

ANALYZED CYLINDER Components	Certified Concentration	Analytical Uncertainty*
Nitric Oxide	225.8 ppm	±1% NIST Directly Traceable
Total Oxides of Nitrogen	227.5 ppm	Reference Value Only

Balance Gas: Nitrogen

+Do not use when cylinder pressure is below 150 psig.
*Analytical accuracy is inclusive of most known error sources which at least include precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
NTRM 1685	8/4/96	ALM-036283	245.3 ppm Nitric Oxide in Nitrogen

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
Beckman 951 0101177	9/10/94	Chemiluminescence

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components
Nitric Oxide

First Triad Analysis

Date: 9/28/94	Response Units: mv	
Z1=0.00	R1=100.00	T1=91.80
R2=100.00	Z2=0.00	T2=91.80
Z3=0.00	T3=91.80	R3=100.00

Avg. Conc. of Cust. Cyl. 225.8 ppm

Second Triad Analysis

Date: 10/6/94	Response Units: mv	
Z1=0.00	R1=100.00	T1=92.00
R2=100.00	Z2=0.00	T2=92.00
Z3=0.00	T3=92.00	R3=100.00

Avg. Conc. of Cust. Cyl: 228.0 ppm

Calibration Curve

Concentration $A+Bx+Cx^2+Dx^3+Ex^4$

r=1.00000	NTRM 1685
Constants:	A=1.16280000
B=2.444100000	C=0.000000000
D=0.000000000	E=0.000000000

Special Notes

Analyst

Customer

Scott Specialty Gases, Inc.
1290 COMBERMERE STREET, TROY, MI 48083 (810) 589-2950 FAX:(810) 589-2134

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
C A E INSTRUMENT RENTAL
246 WOODWORK LANE
PALATINE, IL 60067

Assay Laboratory
Scott Specialty Gases, Inc
1290 Combermere
Troy, MI 48083

Purchase Order : 11475-71500
Scott Project # : 567212

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay and Certification of Gaseous Calibration Standards: Procedure G1; September, 1993.

Cylinder Number : ALM018262
Cylinder Pressure + : 1900 psig

Certificate Date : 6/23/94
Previous Certificate Date : None

Expiration Date : 6/23/96

ANALYZED CYLINDER Components	Certified Concentration	Analytical Uncertainty*
Sulfur Dioxide	84.48 ppm	±1% NIST Directly Traceable

Balance Gas: Nitrogen

+Do not use when cylinder pressure is below 150 psig.
*Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
NTRM 1694	5/10/95	ALM-024038	93.6 ppm Sulfur Dioxide in Nitrogen

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
SO2: Horiba/OPE-135/560372041	5/26/94	Non-Dispersive Infrared

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components
Sulfur Dioxide

First Triad Analysis

Date: 6/14/94 Response Units: mv

Z1=0.00	R1=84.30	T1=85.30
R2=84.30	Z2=0.00	T2=85.30
Z3=0.00	T3=85.30	R3=84.30

Avg. Conc. of Cust. Cyl. 84.48 ppm

Second Triad Analysis

Date: 6/23/94 Response Units: mv

Z1=0.00	R1=84.30	T1=85.30
R2=84.30	Z2=0.00	T2=85.30
Z3=0.00	T3=85.30	R3=84.30

Avg. Conc. of Cust. Cyl: 84.48 ppm

Calibration Curve

Concentration = A + Bx + Cx² + Dx³ + Ex⁴

r=1.00000	NTRM 1694
Constants:	A=-1.27980000
B=0.997790000	C=0.00000000
D=0.000000000	E=0.00000000

Special Notes

Rhonda Lundy
Analyst Rhonda Lundy

Scott Specialty Gases, Inc.

1290 COMBERMERE STREET, TROY, MI 48083 (810) 589-2950 FAX:(810) 589-2134

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
C A E INSTRUMENT RENTAL
246 WOODWORK LANE
PALATINE, IL 60067

Assay Laboratory
Scott Specialty Gases, Inc
1290 Combermere
Troy, MI 48083

Purchase Order : 12021-71500
Scott Project # : 570587

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay and Certification of Gaseous Calibration Standards: Procedure G1; September, 1993.

Cylinder Number : ALM022988
Cylinder Pressure + : 1900 psig

Certificate Date : 9/14/94
Previous Certificate Date : None

Expiration Date : 9/14/96

ANALYZED CYLINDER Components	Certified Concentration	Analytical Uncertainty*
Sulfur Dioxide	149.1 ppm	±1% NIST Directly Traceable

Balance Gas: Nitrogen

+Do not use when cylinder pressure is below 150 psig.
*Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes.

REFERENCE STANDARD Type	Expiration Date	Cylinder Number	Concentration
NTRM 1661	5/25/96	ALM-041665	468.9 ppm Sulfur Dioxide in Nitrogen

INSTRUMENTATION Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
HORIBA AIA 210 566344011	9/6/94	Non-Dispersive Infrared

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components
Sulfur Dioxide

First Triad Analysis

Date: 9/7/94 Response Units: mv

Z1=0.00	R1=100.00	T1=34.20
R2=100.00	Z2=0.00	T2=34.20
Z3=0.00	T3=34.20	R3=100.00

Avg. Conc. of Cust. Cyl. 149.1 ppm

Second Triad Analysis

Date: 9/14/94 Response Units: mv

Z1=0.00	R1=100.00	T1=34.20
R2=100.00	Z2=0.00	T2=34.20
Z3=0.00	T3=34.20	R3=100.00

Avg. Conc. of Cust. Cyl: 149.1 ppm

Calibration Curve

Concentration=A+Bx+Cx^2+Dx^3+Ex^4

r=0.99999	NTRM 1661
Constants:	A=-0.1025626
B=4.192602000	C=0.00497423
D=0.000000000	E=0.00000000

Special Notes

Customer

Analyst

Scott Specialty Gases, Inc.

1290 COMBERMERE STREET, TROY, MI 48083 (810) 589-2950 FAX:(810) 589-2134

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
C A E INSTRUMENT RENTAL
246 WOODWORK LANE
PALATINE, IL 60067

Assay Laboratory
Scott Specialty Gases, Inc
1290 Combermere
Troy, MI 48083

Purchase Order : 12153-71500
Scott Project # : 571394

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay and Certification of Gaseous Calibration Standards; Procedure G1; September, 1993.

Cylinder Number : ALM048204
Cylinder Pressure + : 1900 psig

Certificate Date : 9/27/94
Previous Certificate Date : None

Expiration Date : 9/27/97

ANALYZED CYLINDER Components	Certified Concentration	Analytical Uncertainty*
Propane	8.05 ppm	±1% NIST Directly Traceable

Balance Gas: Nitrogen

+Do not use when cylinder pressure is below 150 psig.
*Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
SRM 2643A	3/28/98	SX-20290	99.12 ppm Propane in Nitrogen

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
Propane : Beckman/400/1002059	9/22/94	Flame Ionization Detector

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components	First Triad Analysis	Second Triad Analysis	Calibration Curve
Propane	Date: 9/27/94 Response Units: ppm Z1=0.00 R1=99.10 T1=8.05 R2=99.10 Z2=0.00 T2=8.10 Z3=0.00 T3=8.10 R3=99.10 Avg. Conc. of Cust. Cyl. 8.05 ppm		Concentration=A+Bx+Cx²+Dx³+Ex⁴ r=1.00000 SRM 2643A Constants: A=-0.0344210 B=1.000000000 C=0.0000000 D=0.000000000 E=0.0000000

Special Notes

Cylinder

Matt C. Bass
Analyst

Scott Specialty Gases, Inc.
1290 COMBERMERE STREET, TROY, MI 48083 (313) 588-2950 FAX: (313) 588-2134

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
CAE INSTRUMENT RENTAL
246 WOODWORK LANE
PALATINE, IL, 60067-2495

Assay Laboratory
Scott Specialty Gases, Inc.
1290 Combermere
Troy, MI 48083

Purchase Order 557399
Scott Project # 557399

ANALYTICAL INFORMATION

Certified to exceed the minimum specifications of EPA Protocol 1 Procedure # G1, Section Number 3.0.4

Cylinder Number ALM005550
Cylinder Pressure 1900 psig

Certification Date 10-27-93
Previous Certification Dates None

General Exp. Date - 10-27-96
Acid Rain Exp. Date 10-27-96

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Propane	24.88 ppm	±1% NIST Directly Traceable

Balance Gas: Nitrogen

*Analytical uncertainty is inclusive of most known error sources which at least includes reference standard error & precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
SRM 2643A	10-14-95	SX-20305	99.12 ppm Propane in N_2

INSTRUMENTATION

Instrument/Model/Serial #
Prop: Beckman/400/1002059

Last Date Calibrated
8-23-93

Analytical Principle
Flame Ionization Detector

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components	First Triad Analysis	Second Triad Analysis	Calibration Curve
Propane	Date: 10-27-93 Response Units: mv Z1=0.00 R1=99.10 T1=24.90 R2=99.10 Z2=0.00 T2=24.90 Z3=0.00 T3=24.90 R3=99.10 Avg. Conc. of Cust. Cyl. 24.88 ppm		Concentration = $A+Bx+Cx^2+Dx^3+Ex^4$ r=0.99999 SRM 2643A Constants: A=-0.05442185 B=1.000549 C=0 D=0 E=0
			Concentration = $A+Bx+Cx^2+Dx^3+Ex^4$
			Concentration = $A+Bx+Cx^2+Dx^3+Ex^4$

Special Notes
If this product is used for Acid Rain Rule Compliance, the *Acid Rain Expiration Date* noted above applies per 40 CFR Part 75, Appendix H. Otherwise, the *General Expiration Date* applies.

Analyst Tim Sanderson

Scott Specialty Gases, Inc.
1290 COMBERMERE STREET, TROY, MI 48083 (313) 589-2950 FAX: (313) 589-2134

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
C A E INSTRUMENT RENTAL
246 WOODWORK LANE
PALATINE, IL 60067-9760

Assay Laboratory
Scott Specialty Gases, Inc.
1290 Combermere
Troy, MI 48083

Purchase Order 10084-71500
Scott Project # 559258

ANALYTICAL INFORMATION

Certified to exceed the minimum specifications of EPA Protocol 1 Procedure #G1, Section Number 3.0.4

Cylinder Number AAL16759
Cylinder Pressure 1900 psig
Certification Date 12-6-93
Previous Certification Dates None
Expiration Date 12-6-96

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Propane	53.80 ppm	±1% NIST Directly Traceable

Balance Gas: Nitrogen

*Analytical uncertainty is inclusive of usual known error sources which at least includes reference standard error & precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
SRM 2643A	10-14-95	SX-20305	99.12 ppm Propane in N_2

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
Prop: Beckman/400/1002059	11-15-93	Flame Ionization Detector

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components	First Triad Analysis	Second Triad Analysis	Calibration Curve
Propane	Date: 12-6-93 Response Units: mv Z1=0.00 R1=99.10 T1=53.80 R2=99.10 Z2=0.00 T2=53.80 Z3=0.00 T3=53.80 R3=99.10 Avg. Conc. of Cust. Cyl. 53.80 ppm		Concentration=A+Bx+Cx²+Dx³+Ex⁴ r=0.99999 SRM 2643A Constants: A=-0.03442105 B=1.000549 C=0 D=0 E=0
			Concentration=A+Bx+Cx²+Dx³+Ex⁴
			Concentration=A+Bx+Cx²+Dx³+Ex⁴

Special Notes

Analyst Frank P. Doran

Bay Airgas

1898 Doolittle Drive
San Leandro, CA 94577
Telephone: 510-297-8900
FAX: 510-352-6184

348075

ANALYTICAL REPORT

To: Sierra Airgas
1545 Industrial Way
Sparks, NV 89431

Date Reported: 07-01-94
Test Number: 04878
Fill Date: 05-31-94
Expire Date: 07-01-96
Product Vol: 230cf

Material Submitted: Air., 0.1

Specification Number: Customer Specification

Method of Analysis: Percent Oxygen Analyzer, Total Hydrocarbon Analyzer, Moisture Monitor, Gas Chromatograph

Result of Investigation: Cylinder No. L61095 Size 300

Component	Specification	Concentration
Oxygen	20.9%	20.4%
Total Hydrocarbons	0.1ppm	<0.1ppm (DL)
Moisture	5ppm	0.8ppm
Carbon Monoxide	0.5ppm	0.25ppm
Carbon Dioxide	1ppm	0.63ppm
Air	Balance	Balance

By _____
Authorized Signature

Bay Airgas

1585 Doolittle Drive
San Leandro, CA 94577
Telephone: 510-297-5900
FAX: 510-352-0154

348054

ANALYTICAL REPORT

To: Sierra Airgas
396 Wolverine Way
Sparks, NV 89431

Date Reported: 07-05-94
Test Number: 04577
Fill Date: 07-05-94
Expire Date: 07-05-96
Product Vol: 208cf

Material Submitted: 40% Hydrogen in Nitrogen

Specification Number: Airgas Specification

Method of Analysis: Gas Chromatograph, Total Hydrocarbon Analyzer

Result of Investigation: Cylinder No. N413824 Size 200

Component	Specification	Concentration
Hydrogen	40%	40.6%
Total Hydrocarbons	0.5ppm	<0.2ppm (DL)
Nitrogen	Balance	Balance

By _____
Authorized Signature

HOME OFFICE:
P.O. BOX 19755
1725 69th STREET
SACRAMENTO, CALIFORNIA 95819
(916) 732 2358
FAX: (916) 454-9263

Sierra Airgas

Serving
California and Nevada
Since 1938

PRODUCT CERTIFICATION

Nitrogen, UHP Grade 5. has been analyzed and meets the following Minimum Specifications:

BATCH #	516941
CYLINDER S/N	KH 503487
OXYGEN	0.3 PPM
THC	N/D PPM
MOISTURE	2.5 PPM

Analyst

file:

APPENDIX G

NOMENCLATURE AND EQUATIONS

1. ABSOLUTE PRESSURE, P_m and P_s (inches Hg).

$$P_m = P_{bar} + \frac{\Delta H}{13.6}$$

$$P_s = P_{bar} + \frac{P_{static}}{13.6}$$

2. DRY GAS METER VOLUME, STANDARD CONDITIONS, $V_{m_{std}}$ (dscf).

$$V_{m_{std}} = \frac{17.65\ V_m\ \gamma_m P_m}{T_m}$$

3. WATER VAPOR VOLUME, STANDARD CONDITIONS, $V_{w_{std}}$ (scf).

$$V_{w_{std}} = 0.04707\ V_{lc}$$

4. MOISTURE CONTENT, B_{wo} (percent).

Gravimetric Method:

$$B_{wo} = \frac{V_{w_{std}}}{V_{m_{std}} + V_{w_{std}}}$$

5. STACK GAS MOLECULAR WEIGHT, M_s (lb/lb-mole).

$$M_s = (1-B_{wo})\ [0.44\ (\%\ CO_2) + 0.32\ (\%\ O_2) + 0.28\ (\%\ N_2 + \%\ CO)] + 18\ B_{wo}$$

6. AVERAGE STACK GAS VELOCITY, v_s (ft/sec).

$$v_s = 85.48\ C_p\ (\Delta P)_{avg}^{0.5}\ (T_s / P_s\ M_s)^{0.5}$$

7. AVERAGE STACK GAS VOLUMETRIC FLOW RATE, Q_s (dscf/hr).

$$Q_s = \frac{63{,}529\ (1-B_{wo})\ v_s\ A_s\ P_s}{T_s}$$

8. ISOKINETIC SAMPLING RATE, I (percent).

$$I = \frac{1.667\ T_s\ [0.00267\ V_{lc} + (V_m\ \gamma_m\ P_m/T_m)]}{\theta\ v_s\ P_s\ A_h}$$

$$I = \frac{0.0945\ T_s\ V_{m_{std}}}{\theta\ v_s\ P_s\ A_h\ (1 - B_{wo})}$$

9. PM_{10} Emission Rate, $W_{PM_{10}}$ (lb/hr).

$$W_{PM_{10}} = \frac{M_n + M_{CPM}}{V_{m_{std}}} \times Q_s$$

11. THC CONCENTRATION AS CARBON, C_c (ppmv)

$$C_c\ (ppmv) = 3 \times C_{meas(propane)}$$

12. THC EMISSION RATE AT STACK, W_{THC}

$$W_{THC} = C_c \times D_{C_3H_8} \times Q_s \times 10^{-6}$$

13. NO_x CONCENTRATION, $C_{gas\ NO_x}$ (ppmv).

$$C_{gas\ NO_x}(ppmv) = (C_{stack\ NO_x} - C_0) \times \frac{C_{ma}}{C_m - C_0}$$

14. NO_x EMISSION RATE AT STACK, W_{NO_x} (lb/hr).

$$W_{NO_x} = C_{gas\ NO_x} \times D_{NO_x} \times Q_s \times 10^{-6}$$

15. CO CONCENTRATION, C_{CO} (ppmv).

$$C_{CO}\ (ppmv) = C_{CO\ NDIR} \times (1 - \%\ CO_2)$$

16. CO EMISSION RATE AT STACK, W_{CO} (lb/hr)

$$W_{CO} = C_{CO\ stack} \times D_{CO} \times Q_s \times 10^{-6}$$

17. SO_2 CONCENTRATION, $C_{gas\ SO_2}$ (ppmv).

$$C_{gas\ SO_2}(ppmv) = (C_{stack\ SO_2} - C_0) \times \frac{C_{ma}}{C_m - C_0}$$

18. SO_2 EMISSION RATE AT STACK, W_{SO_2} (lb/hr).

$$W_{SO_2} = C_{gas\ SO_2} \times D_{SO_2} \times Q_s \times 10^{-6}$$

19. Metal Emission Rate, W_{metal} (g/hr).

$$W_{metal} = \frac{M_{metal} \times 10^{-6}\ g/ug}{V_{m_{std}}} \times Q_s$$

20. AVERAGE HEAT INPUT TO THERMAL OXIDIZER, HI_{avg} (MBTU)

$$HI_{avg} = RF \times HV_{ar}$$

NOMENCLATURE USED IN EQUATIONS

Symbol	Units	Description
A_n	ft^2	Cross-sectional area of nozzle
A_s	ft^2	Cross-sectional area of stack
B_{wo}	decimal	Mole fraction of stack gas water content
C_0	ppmv	Average of initial and final system bias calibration check responses for the zero gas.
C_{CO}	ppmv	Corrected CO concentration of stack gas
$C_{CO\ NDIR}$	ppmv	CO concentration of stack gas, as measured by the continuous emission monitor
$C_{gas\ SO_2}$	ppmv	Effluent gas concentration, dry basis
$C_{gas\ NO_x}$	ppmv	Effluent gas concentration, dry basis
C_m	ppmv	Average of initial and final system calibration bias check responses for the upscale calibration gas.
C_{ma}	ppmv	Actual concentration of the upscale calibration gas.
$C_{meas(propane)}$	ppmv	Concentration measured as propane.
C_p	-	S-type pitot tube coefficient
$C_{stack\ SO_2}$	ppmv	Average gas concentration indicated by the gas gas analyzer, dry basis
$C_{stack\ NO_x}$	ppmv	Average gas concentration indicated by the gas gas analyzer, dry basis
CO	%	Concentration of carbon monoxide in gas stream as measured by an Orsat, dry basis
CO_2	%	Concentration of carbon dioxide in gas stream as measured by an Orsat, dry basis
$D_{C_3H_8}$	lb/ft^3	Density of propane as a gas, dry standard
D_{CO}	lb/ft^3	Density of CO as a gas, dry standard
D_{SO_2}	lb/ft^3	Density of SO_2 as a gas, dry standard
$\triangle H$	inch H_2O	Average pressure drop across orifice meter
HI	MMBtu/hr	Heat input to boiler

HV_{ar}	Btu/lb, Btu/gal, Btu/ft^3	Heating value of fuel, as received
I	%	Ratio to which sampling velocity approaches stack velocity, and is 100 percent when the two are equal
M_5	mg	Total particulate matter collected from RM 5 portion of the PM_{10} train.
M_{CPM}	mg	Total CPM collected in the Method 202 portion of the PM_{10} train.
M_{metal}	ug	Total metal collected in the MMe train
M_s	lb/lb mole, wet	Molecular weight of stack gas
N_2	%	Concentration of nitrogen in stack gas, as measured by an Orsat, dry basis
O_2	%	Concentration of oxygen in stack gas, as measured by an Orsat, dry basis
ΔP	inch H_2O	Velocity head of stack gases
P_{bar}	inch Hg	Barometric pressure at local elevation
P_m	inch Hg	Absolute pressure (barometric + ΔH) at meter
P_s	inch Hg	Absolute pressure (barometric + P_{stat} in stack)
P_{stat}	inch H_2O	Static pressure in stack
Q_s	dscf/hr	Average stack gas volumetric flow rate, dry, at standard conditions
RF	lb/hr, ft^3/hr	Feed rate of fuel
T_m	°R	Average dry gas meter temperature (°F + 460)
T_s	°R	Average stack gas temperature (°F + 460)
T_{std}	°R	Standard absolute temperature, 530 °R
V_{lc}	g	Total mass of liquid collected in impingers and silica gel
V_m	ft^3	Volume of gas through dry gas meter at meter conditions
$V_{m\ std}$	dscf	Volume of dry gas sampled at standard conditions
V_s	ft/sec	Average stack gas velocity at sampling site
V_{sol}	mL	Total volume of impinger solution

$V_{W_{std}}$	scf	Water vapor volume at standard conditions
W_{CO}	lb/hr	Mass emission rate of CO at the stack
W_{metal}	g/hr	Mass emission rate of a particular metal at the stack
W_{NO_x}	lb/hr	Mass emission rate of NO_x at the stack
$W_{PM_{10}}$	lb/hr	Mass emission rate of PM_{10} at the stack
W_{SO_2}	lb/hr	Mass emission rate of SO_2 at the stack
W_{THC}	lb/hr	Mass emission rate of THC at the stack
θ	min	Total sampling time
γ_m	-	Dry gas meter coefficient

APPENDIX H

USACHPPM ASSESSMENT PERSONNEL

USACHPPM Personnel	Duty:
John Litynski	Project Officer
Parrish Galusky	Assistant Project Officer
Donald Keesee	Engineering Technician
Emery Thompson	Physical Science Technician
James Pritts	CEMS Technician

APPENDIX I

SAMPLING TRAIN FIELD DATA SHEETS AND SUMMARY

TABLE I-1. METALS TRAIN DATA SUMMARY

DATE	RUN 2 10/21/94	RUN 4 10/24/94	RUN 6 10/27/94
OPERATING CHARACTERISTICS			
Average Batch Feed			
175mm COMP B Proj (No.)	480	480	480
(lb/ea)	115	115	115
(tons)*	27.6	27.6	27.6
STACK GAS DATA			
Barometric Pressure (in. Hg)	26.35	26.15	26.2
Static Pressure (in. Hg)	-0.13	-0.14	-0.14
Average Stack Gas Temperature ($_oF$)	1794	1790	1789
Stack Gas Moisture Content (%)	7.31	5.13	7.45
Stack Area (ft^2)	15.904	15.904	15.904
Stack Gas Velocity (ft/sec)	21.36	18.15	19.79
Volumetric Flow Rate (dscf/hr)	233766	202153	215519
CO_2 Concentration (%, dry)	8.0	7.2	7.8
O_2 Concentration (%, dry)	10.8	12.0	11.2
CO Concentration (%, dry)	0.0	0.0	0.0
N_2 Concentration (%, dry)	81.2	80.8	81.0
Stack Gas Molecular Weight (lb/lb-mole, wet)	28.86	29.04	28.82
SAMPLING EQUIPMENT DATA			
Gas Volume Sampled at Meter Conditions (dcf)	36.024	37.851	41.69
Dry Gas Volume (dscf)	32.90	33.81	37.66
Total Sampling Time (min)	60	72	72
Pitot Tube Coefficient	0.831	0.831	0.831
Average Pressure Drop Across Meter Orifice (in H_2O)	1.11	0.822	0.965
Average Dry Gas Meter Temperature ($_oF$)	51.6	58.7	54
Sampling Nozzle Area (ft^2)	0.0021	0.0021	0.0022
Dry Gas Meter Coefficient	1.002	1.002	1.002
Average Stack Gas Velocity Head (in $H_2O)^{0.5}$	0.175	0.148	0.161
Total Liquid Collected (mL)	55.1	38.8	64.4
Isokinetic Sampling Rate (%)	104.53	103.51	105.49

* Batch feed rate exceeds previous limit of 25 tons.

TABLE I-2. PM_{10} TRAIN DATA SUMMARY

DATE	RUN 1* 10/20/94	RUN 3 10/23/94	RUN 5 10/26/94	RUN 7 10/29/94
OPERATING CHARACTERISTICS				
Average Batch Feed				
175mm COMP B Proj (No.)	480	480	480	480
(lb/ea)	115	115	115	115
(tons)*	27.6	27.6	27.6	27.6
STACK GAS DATA				
Barometric Pressure (in. Hg)	26.1	26.45	26.11	26.2
Static Pressure (in. H_2O)	*	-0.14	-0.13	-0.135
Average Stack Gas Temperature ($_oF$)	1667	1797	1778	1748
Stack Gas Moisture Content (%)	*	6.12	7.76	7.53
Stack Area (ft^2)	15.904	15.904	15.904	15.904
Stack Gas Velocity (ft/sec)	*	20.21	21.82	22.24
Volumetric Flow Rate (dscf/hr)	*	224552	237201	246472
CO_2 Concentration (%, dry)	7.8	7.8	7.6	8.0
O_2 Concentration (%, dry)	11.0	10.6	11.4	10.8
CO Concentration (%, dry)	0.0	0.0	0.0	0.0
N_2 Concentration (%, dry)	81.2	81.6	81.0	81.2
Stack Gas Molecular Weight (lb/lb-mole, wet)	*	28.96	28.77	28.83
SAMPLING EQUIPMENT DATA				
Gas Volume Sampled at Meter Conditions (dcf)	*	73.293	77.351	80.158
Dry Gas Volume (dscf)	*	62.722	64.295	70.139
Total Sampling Time (min)	*	120	120	120
Pitot Tube Coefficient	0.831	0.831	0.831	0.831
Average Pressure Drop Across Meter Orifice (in H_2O)	*	1.023	1.166	1.307
Average Dry Gas Meter Temperature ($_oF$)	*	88.0	97.0	71.1
Sampling Nozzle Area (ft^2)	*	0.0021	0.0021	0.0022
Dry Gas Meter Coefficient	1.002	1.002	1.002	1.002
Average Stack Gas Velocity Head (in $H_2O)^{0.5}$	*	0.164	0.175	0.180
Total Liquid Collected (mL)	*	86.932	114.94	121.35
Isokinetic Sampling Rate (%)	*	103.75	100.68	103.09

* Test Run 1 - PM_{10} train failed intermediate leak check.
† Batch feed rate exceeds previous limit of 25 tons.

(2)

FIELD DATA SHEET — RUN NO. MeMMMc3-1 DATE 10-~~28~~-94

GENERAL

Project Number	Installation Hawthorne AAP	Meter Box Operator D Kaiser
Sample Location: HGD System		
Type of Sample: Acid Mist POHC (Metals) Moisture Particulate		
SO_2 SO_3 SO_4 Particle Size Other:		

EQUIPMENT SPECIFICATIONS

Nomograph/Calculator		Nozzle		Pitot Tube	
$\Delta H_@$ 1.82	ΔP_{avg} 0.0342	No.	D_n	No.	C_p
$\%H_2O$ 7.5%	P_s/P_m 1.0	206.0.20-1	.626	WC-1	0.84
T_m 92 (55)	T_s 1780		.627	$F_{Wall\ Effect}$	
"C" Factor 0.84	K_p 38.06		.627	$C_{p\,adj}$ ~~0.856~~ .831	
Ref ΔP		D_{avg} .6267		A_n 0.3085 in^2	
Meter Box No. 2928		Dry Gas Meter Y_m 1.002		D_t 4.5 ft	A_t 15.904 ft^2

Filter		Probe	
Type	Number	Length	Liner Material
		5' eff	Quartz
		Probe Heat Setting	240°F

OPERATIONAL CHECKS

Initial Leak Check		Initial Pitot Tube Leak Check
Vacuum (in. Hg)	Leak Rate	0.00/0.00 in. H_2O per 15 ~~Min.~~
15	0.009 ft^3 per , Min.	at 4.4/4.2 in. H_2O
Final Leak Check		**Final Pitot Tube Leak Check**
Vacuum (in. Hg)	Leak Rate	0.00/0.00 in. H_2O per 15 ~~Min.~~
3.1	0.000 ft^3 per / Min.	at 4.6/4.5 in. H_2O
Gas Bag System Leak Check		**Component Leak Check**
Initial 0.0	Final 0.0	Vacuum (in Hg.) / Leak Rate
P_{bar} 26.35	P_{man} ~~26.35~~ -.13	ft³ per Min.
Start Time 0528	End Time 0628	ft³ per Min.

Point No.	θ (min)	V_m (ft³) 053.500	ΔP inches H_2O	$(\Delta P)^{1/2}$	ΔH inches H_2O	T_m (°F) t_i	t_f	T_s (°F)	Vacuum inches Hg	Final Imp. Temp. (°F)	Filter Temp. (°F)	Remarks Kfg 35-06 fnish T
1	2.5	054.63	.015	.122	.571	47	47	1605	2	35	24[illegible]	240
2	5	056.77	.015	.122	.571	48	47	1625	2	35	245	230
3	7.5	056.96	.017	.130	.650	50	47	1820	2	36	245	232
4	10	058.22	.022	.148	.770	51	47	1834	2	35	247	231
5	12.5	059.52	.022	.148	.770	52	48	1826	2	35	250	235
6	15	060.85	.022	.148	.770	53	47	1827	2	35	252	240
7	17.5	062.	.020	.141	.682	53	47	1816	2	35	251	241
8	20	063.40	.020	.141	.682	53	48	1834	2	35	251	240
9	22.5	064.5	.020	.141	.682	53	48	1835	2	36	251	242
10	25	065.	.020	.141	.682	53	48	1837	2	36	250	242
11	27.5	066.7	.020	.141	.682	53	48	1824	2	35	248	242
12	30	067.94	.018	.134	.614	53	48	1824	2	35	249	241
13	32.5	068	.030	.173	1.02	55	49	1806	2.5	35	250	246
14	35	070.94	.030	.173	1.02	55	49	1808	2.5	36	254	245
15	37.5	072.51	.032	.179	1.09	56	49	1798	2.5	34	255	244
16	40	074.0	.032	.179	1.09	57	49	1795	2.5	35	255	240
17	42.5	075.72	.040	.200	1.36	58	50	1786	2.5	35	255	241
18	45	077.56	.050	.224	1.71	58	50	1793	3.0	36	253	240
19	47.5	079.5	.052	.228	1.77	58	50	1782	3.0	36	254	241
20	50	081.37	.052	.228	1.77	58	51	1790	3.0	36	253	238
21	52.5	083.28	.052	.228	1.77	58	51	1779	3.0	37	256	237
22	55	085.24	.055	.235	1.88	58	51	1803	3.1	39	255	238
23	57.5	087.35	.063	.251	2.15	58	51	1809	3.1	40	252	237
24	60	089.524	.055	.235	1.88	58	51	1807	3.1	40	250	243
					Avg	54.42	48.79					
TOTAL		36.024										
AVERAGE 1			0323	.746	1.110	51.60	°F	1714.25 F				
							+460	+460				
AVERAGE 2						511.6	R	2254.25 R				

Run # : MMe-1

Date : 10-21-94

ISOKINETIC SHEET (68 degree reference)

# Probes	Dp=	Ds=				
1	3	54				
Cp,corr.=	Ts=	As=	Vm=	Pbar=	Theta=	SQR(ΔP)=
0.8310	1794.25	15.9043	36.024	26.35	60	0.1746

		Dn=			
		0.6267			
ΔH=	Tm=	An=	Ym=	Pstat=	
1.11	51.6	0.00214	1.002	-0.13	

Vlc=	Mn=	%CO2	%O2	%N2	%CO
55.1	0	8.00	10.80	81.20	0.00

RESULTS

Pm=	26.43	"Hg	C's=	0	gr/dscf
Ps=	26.34	"Hg	EA=	102	%
Vm,std=	32.90	scf	Erate=	0.000	lb/hr
Vw,std=	2.59	scf			
Bwo=	0.0731				
Ms=	28.86	lb/lb-mol, wet			
Vs,avg=	21.36	ft/sec			
Qs=	233,766	dscf/hr			
I=	104.53	%			

(4)

FIELD DATA SHEET	RUN NO. MMe B-2	DATE 10-24-94

GENERAL

Project Number	Installation Hawthorne AAP	Meter Box Operator D Keesee
Sample Location HGO System		
Type of Sample: Acid Mist POHC (Metals) Moisture Particulate		
SO_2 SO_3 SO_x Particle Size Other:		

EQUIPMENT SPECIFICATIONS

Nomograph/Calculator		Nozzle		Pitot Tube	
$\Delta H_@$ 1.82	ΔP_{avg} 0.0323	No.	D_s	No.	C_p
%H_2O 7.5	P_s/P_m 10	206.Q.20-1	.626	WC-1	0.84
T_m 55	T_s 1795		.627	$F_{blockage}$	
"C" Factor	K_p ~~33.74~~ 34.39		.627	C_{pitot} ~~.836~~ .837	
Ref ΔP		$D_{n,avg}$ .6267		A_n 0.3085 in^2	
Meter Box No. 2928		Dry Gas Meter Y_m 1.002		D_t 4.5 in	A_t 15.904 ft^2

Filter		Probe	
Type	Number	Length	Liner Material
		5' ea	Quartz
		Probe Heat Setting	

OPERATIONAL CHECKS

Initial Leak Check		Initial Pitot Tube Leak Check
Vacuum (in. Hg)	Leak Rate	0.000/0.000 in. H_2O per 15 Min.
15	0.005 ft^3 per 1 Min.	at 4.7/4.8 in. H_2O
Final Leak Check		**Final Pitot Tube Leak Check**
Vacuum (in. Hg)	Leak Rate	0.000/0.000 in. H_2O per 15 Min.
2.9	0.000 ft^3 per 1 Min.	at 4.8/4.9 in. H_2O
Gas Bag System Leak Check		**Component Leak Check**
Initial OK	Final OK	Vacuum (in Hg.) / Leak Rate
P_{bar}	P_{stat} — .14	ft³ per Min.
Start Time 0750	End Time 0840	ft³ per Min.

nt	Θ (min)	V_m (ft³) 185.400	ΔP inches H_2O	$(\Delta P)^{1/2}$	ΔH inches H_2O	T_m (°F) t_i	t_f	T_s (°F)	Vacuum inches Hg	Final Imp. Temp. (°F)	Filter Temp. (°F)	Remarks KF ~~33.74~~ 34.39 Probe T
	3	186.77	.015	.122	.516	60	58	1640	2.0	39	248	228
	6	188.10	.015	.122	.516	60	58	1793	2.0	38	250	230
	9	189.7	.020	.141	.690	61	59	1818	2.0	38	246	243
	12	190.98	.015	.122	.516	61	59	1828	2.0	39	245	245
	15	192.37	.017	.130	.585	61	58	1827	2.0	39	246	236
	18	193.49	.010	.100	.345	61	58	1807	2.0	39	248	238
	21	195.03	.023	.152	.791	62	58	1790	2.0	39	248	239
	24	197.05	.040	.200	1.38	62	58	1802	2.2	39	247	230
	27	1992	.043	.207	1.48	63	59	1796	2.5	39	249	237
	30	201.61	.055	.235	1.89	63	58	1797	2.8	39	248	240
	33	204.03	.055	.235	1.89	64	59	1792	2.8	41	251	242
	36	206.498 ~~206.60~~ ~~206.550~~	.058	.241	1.99	64	59	1792	2.9	42	255	244
13	3	208.30	.025	.158	.860	57	56	1733	2.0	39	246	238
14	6	209.84	.020	.141	.690	57	56	1801	2.0	39	247	236
15	9	211.18	.015	.122	.516	58	56	1779	2.0	39	244	238
16	12	212.92	.025	.158	.860	59	56	1841	2.1	39	240	240
17	15	214.45	.020	.141	.690	60	56	1826	2.0	39	238	234
18	18	216.16	.027	.164	.930	60	56	1824	2.2	38	234	236
19	21	217.50	.015	.122	.516	60	56	1797	2.0	39	236	245
20	24	218.61	.010	.100	.345	59	56	1770	2.0	39	237	240
21	27	219.92	.015	.122	.516	59	56	1785	2.0	40	239	234
22	30	221.00	.010	.100	.345	59	55	1771	2.0	39	242	232
23	33	222.29	.015	.122	.516	59	55	1765	2.0	39	243	232
24	36	223.363	.010	.100	.345	59	55	1773	2.0	38	242	231
TOTAL		37.851										
AVERAGE 1				0.1484	0.822	58.7	°F	1793	°F			
							+460		+460			
AVERAGE 2						518.7	R	2253	R			

Run # : MMe-2 Date : 10-24-94

ISOKINETIC SHEET (68 degree reference)

# Probes	Dp=	Ds=				
1	.3	54				
Cp,corr.=	Ts=	As=	Vm=	Pbar=	Theta=	SQR(ΔP)=
0.8310	1790	15.9043	37.851	26.15	72	0.1484

		Dn=		
ΔH=	Tm=	An=	Ym=	Pstat=
0.822	58.7	2.142E-03	1.002	-0.14

Vlc=	Mn=	%CO2	%O2	%N2	%CO
38.8	0	7.20	12.00	80.80	0.00

RESULTS

Pm=	26.21	"Hg	C's=	0	gr/dscf
Ps=	26.14	"Hg	EA=	129	%
Vm,std=	33.81	scf	Erate=	0.000	lb/hr
Vw,std=	1.83	scf			
Bwo=	0.0513				
Ms=	29.04	lb/lb-mol, wet			
Vs,avg=	18.15	ft/sec			
Qs=	202,153	dscf/hr			
I=	103.51	%			

FIELD DATA SHEET	RUN NO. MMc - 3 (6)	DATE 10-27-94

GENERAL

Project Number	Installation Hawthorne AAP	Meter Box Operator D Kuesis
Sample Location: HGD System		
Type of Sample: Acid Mist POHC (Metals) Moisture Particulate SO_2 SO_3 SO_x Particle Size Other:		

EQUIPMENT SPECIFICATIONS

Nomograph/Calculator		Nozzle		Pitot Tube	
$\Delta H_@$ 1.82	ΔP_{avg}	No.	D_n	No.	C_p
$\%H_2O$ 7.5	P_s/P_m 1.0	206.0.20-2	.635	WC-1	0.84
T_m 55	T_s 1500		.635	$F_{blockage}$	
"C" Factor	K 3539		.634	$C_{p,adj}$	~~.8482~~ ~~.856~~ .831
Ref ΔP		$D_{n,avg}$ .6346		A_n $2.142\ E^{-3}$	
Meter Box No. 2928		Dry Gas Meter Y_m 1.002		D_s 4.5'	A_s 15.904

Filter		Probe	
Type	Number	Length	Liner Material
		5' ea	Quartz
		Probe Heat Setting	

OPERATIONAL CHECKS

Initial Leak Check		Initial Pitot Tube Leak Check
Vacuum (in. Hg)	Leak Rate	~~0.000/0.000~~ in. H_2O per ~~15~~ Min.
15	0.008 ft^3 per 1 Min.	at 19.21 in. H_2O
Final Leak Check		**Final Pitot Tube Leak Check**
Vacuum (in. Hg)	Leak Rate	_____ in. H_2O per _____ Min.
2.5	0.000 ft^3 per 1 Min.	at _____ in. H_2O

Gas Bag System Leak Check		Component Leak Check	
Initial	Final	Vacuum (in Hg.)	Leak Rate
P_{bw} OK	P_{avg} -.14		ft^3 per Min.
Start Time 0450	End Time 0625		ft^3 per Min.

Point No.	θ (min)	V_m (ft^3) 330798	ΔP inches H_2O	$(\Delta P)^{1/2}$	ΔH inches H_2O	T_m (°F) t_i	t_f	T_s (°F)	Vacuum inches Hg	Final Imp. Temp. (°F)	Filter Temp. (°F)	Remarks Probe T
1	3	332.50	.023	.152	.814	53	52	1817	2.0	36	234	226
2	6	334.28	.025	.158	.855	53	52	1820	2.0	34	236	235
3	9	335.79	.023	.152	.814	54	52	1823	2.0	35	242	240
4	12	337.35	.020	.141	.710	55	53	1810	2.0	34	245	241
5	15	338.95	.022	.148	.780	56	52	1805	2.0	33	246	238
6	18	340.12	.010	.100	.354	57	53	1798	2.0	36	250	240
7	21	341.64	.020	.141	.710	57	52	1776	2.0	36	252	240
8	24	343.13	.018	.134	.637	57	53	1784	2.0	35	251	246
9	27	344.97	.030	.173	1.062	58	53	1765	2.2	36	253	252
10	30	347.04	.040	.200	1.420	59	53	1769	2.2	37	257	250
11	33	349.27	.045	.212	1.593	60	54	1760	2.3	38	256	242
12	36	351.334	.038	.195	1.345	60	54	1757	2.2	38	254	235
		351.501										
13	3	354.70	.033	.182	1.168 1.700	51	51	1782	2.0	35	233	230
14	6	355.73	.045	.212	1.593	52	51	1815	2.5	36	236	228
15	9	357.75	.038	.195	1.345	53	51	1808	2.2	36	243	245
16	12	359.94	.045	.212	1.593	55	51	1834	2.3	37	252	236
17	15	362.14	.048	.219	1.699	56	51	1816	2.4	37	251	235
18	18	364.07	.030	.173	1.062	57	51	1812	2.0	38	252	232
19	21	365.56	.015	.122	.531	57	51	1782	2.0	38	254	233
20	24	366.82	.013	.114	.460	57	52	1767	2.0	38	251	231
21	27	368.16	.015	.122	.531	56	52	1772	2.0	37	251	232
22	30	369.76	.023	.152	.814	57	52	1751	2.0	37	252	234
23	33	371.12	.015	.122	.531	57	52	1759	2.0	38	254	237
24	36	372655	.020	.141	.710	57	52	1751	2.0	38	254	233
TOTAL		41.690		Σ								
AVERAGE 1				0.1614	0.965	54.0 °F		1788.9 °F				
						+460		+460				
AVERAGE 2						514.0 R		2248.9 R				

Run # : MMe-3 Date : 10-27-94

ISOKINETIC SHEET (68 degree reference)

# Probes	Dp=	Ds=				
1	3	54				
Cp,corr.=	Ts=	As=	Vm=	Pbar=	Theta=	SQR(ΔP)=
0.8310	1788.9	15.9043	41.69	26.2	72	0.1614

			Dn=		
			0.6346		
ΔH=	Tm=		An=	Ym=	Pstat=
0.965	54		0.00220	1.002	-0.14

Vlc=	Mn=	%CO2	%O2	%N2	%CO
64.4		7.80	11.20	81.00	0.00

RESULTS

Pm=	26.27	"Hg	C's=	0	gr/dscf
Ps=	26.19	"Hg	EA=	110	%
Vm,std=	37.66	scf	Erate=	0.000	lb/hr
Vw,std=	3.03	scf			
Bwo=	0.0745				
Ms=	28.82	lb/lb-mol, wet			
Vs,avg=	19.79	ft/sec			
Qs=	215,519	dscf/hr			
I=	105.49	%			

FIELD DATA SHEET	RUN NO M202 - 1 (3)	DATE 10-23-94

GENERAL

Project Number	Installation Hawthorne AAP	Meter Box Operator D K...
Sample Location	HGD System	
Type of Sample:	Acid Mist POHC Metals Moisture (Particulate)	
	SO_2 SO_3 SO_x Particle Size Other:	

EQUIPMENT SPECIFICATIONS

Nomograph/Calculator		Nozzle		Pitot Tube	
$\Delta H_@$ 1.82	ΔP_{wt} 0.0323	No.	D_s	No.	C_p
%H_2O 7.5	P_s/P_m 1.0	206.Q.20-1	.626	WC-	0.84
T_m 90	T_s 1800		.627	$F_{blockage}$	
"C" Factor	K_p 35.95		.627	C_{pitt}	0.84 .831
Ref ΔP		D_{nozz} .6267		A_n .3085 m^2	
Meter Box No. 2923		Dry Gas Meter Y_m		D_s 4.58ft	A_s 15.9041 ft^2

Filter		Probe	
Type	Number	Length	Liner Material
Quartz	Z-3	5' off	Quartz
		Probe Heat Setting	240°F

OPERATIONAL CHECKS

Initial Leak Check		Initial Pitot Tube Leak Check
Vacuum (in. Hg)	Leak Rate	0.000 in. H_2O per 15 ~~Min.~~
1 15	0.005 ft³ per 1 Min.	at 4.6 / 4.3 in. H_2O
2 15	Final Leak Check 0.006 1 Min.	Final Pitot Tube Leak Check
Vacuum (in. Hg)	Leak Rate	0.000 in. H_2O per 15 ~~Min.~~
1 4.0	0.000 ft³ per 1 Min.	at 4.7 / 4.5 in. H_2O
2 4.0	0.001 1 Min.	
Gas Bag System Leak Check		Component Leak Check
Initial 0.0	Final 0.0	Vacuum (in Hg.) / Leak Rate
P_{bar} 26.45	P_{abs} ~~26.15~~ .14	ft³ per Min.
Start Time 1105	End Time 1320	ft³ per Min.

nt	θ (min)	V_m (ft^3) 104.105	ΔP inches H_2O	$(\Delta P)^{1/2}$	ΔH inches H_2O	T_m (°F) t_i	t_f	T_s (°F)	Vacuum inches Hg	Final Imp. Temp. (°F)	Filter Temp. (°F)	Remarks KP 39.95 Probe Temp °F
	5	107.05	.025	.158	.999	53	52	1616	2.5	59	234	225
2	10	110.09	.025	.158	.999	84	81	1769	2.5	61	242	244
3	15	112.89	.020	.141	.799	86	82	1794	2.0	60	249	238
4	20	115.67	.020	.141	.799	87	82	1798	2.0	61	251	232
5	25	118.59	.023	.152	.919	58	83	1807	2.2	61	249	230
6	30	121.86	.030	.173	1.20	90	83	1811	3.0	62	251	231
7	35	125.45	.037	.192	1.48	91	83	1780	3.5	59	252	247
8	40	129.08	.037	.192	1.48	92	85	1762	3.5	55	252	246
9	45	132.87	.040	.200	1.60	92	86	1760	4.0	59	247	249
10	50	136.04	.025	.158	~~1.58~~ .999	93	86	1758	2.5	58	247	243
11	55	139.39	.013	.114	.520	93	87	1764	2.0	60	244	230
12	60	140.154	.013	.114	.520	93	87	1768	2.0	60	246	232
13	05 *	140.900 142.200	.015	.122	.510	88	89	1614	2.0	60	250	235
14	10	145.66	.018	.134	.611	88	88	1809	2.0	53	238	230
15	15	148.24	.020	.141	.660	90	88	1864	2.2	49	242	240
16	20	150.97	.022	.148	.750	89	85	1860	2.2	42	246	236
17	25	153.82	.025	.158	.850	89	84	1879	2.5	43	248	234
18	30	156.97	.030	.173	1.02	90	84	1889	2.8	44	252	241
19	35	160.11	032	179	1.09	91	85	1860	2.8	44	254	250
20	40	163.35	.033	.182	1.12	92	86	1851	3.0	50	256	251
21	45	166.73	037	.192	1.26	93	87	1837	3.2	47	256	234
22	50	170.23	.040	.200	1.36	94	88	1833	3.3	47	254	232
23	55	173.85	.042	.205	1.43	95	89	1831	3.5	50	252	237
24	60	177.398	.040	.200	1.36	96	90	1823	3.3	53	253	240
					avg	103	55.42					
TOTAL		73.293										
AVERAGE 1			.028	.164	1.023	87.8 °F		1797 °F				
						~~547.9~~ +460		+460				
AVERAGE 2						547.9 °R		2257 °R				

PM10 Train Summary Data Calculations

Date: 10-23-94
Plant: HWAAP HGDS
Run No: 3

	DATA
Units, Metric(1) or English(2):	2
Barometric Pressure(mm Hg, in. Hg):	26.45
Stack Static Pressure(mm H2O, in. H2O):	-0.14
Stack Area(m^2, ft^2):	15.9043
Nozzle Diameter(mm, in.):	0.6267
Pitot Tube Coefficient, Cp:	0.831
DGM Calibration Factor, Y:	1.002
Initial DGM Reading(liters, dscf):	104.105
Final DGM Reading(liters, dscf):	177.398
Total Run Time(min):	120

FILTER, NOZZLE RINSE, AND MOISTURE DATA

	DATA
Dry Molecular Weight of Stack Gas:	28.9571709
Particulate Mass in Probe Rinse(mg):	9.91
Particulate Mass in Filter Catch(mg):	21.72
Water Vapor Condensed in Impingers(ml):	69.2
Water Vapor Collected in Silica Gel(g):	17.7
% CO2	7.80%
% O2	10.60%
% N2	81.60%
% CO	0.00%

RESULTS

Average DGM Temperature(K, R):	547.858
Average Orifice Press. Drop(mm H2O, in. H2O):	1.023
Standard Dry Gas Volume, Vm(std)(dscm, dscf):	62.722
Stack Gas Velocity(m/s, f/s):	20.213
Standard Volumetric Flow Rate(dscmm, dscfm):	3742.534
Standard Volumetric Flow Rate(dscmh,dscfh):	224552.055
Volume of Water Vapor(scm, scf):	4.092
Moisture Content(%):	6.124
Isokinetics:	103.752

FIELD DATA SHEET	RUN NO. PM10 - 2 (5)	DATE 10/26/94

GENERAL

Project Number	Installation Hawthorne AAP	Meter Box Operator D Kester
Sample Location HGD System		
Type of Sample: Acid Mist POHC Metals Moisture Particulate		
SO_2 SO_3 SO_x Particle Size Other:		

EQUIPMENT SPECIFICATIONS

Nomograph/Calculator		Nozzle		Pitot Tube	
$\Delta H_@$ 1.82	ΔP_{std} 0.6323	No.	D_n	No.	C_p
$\%H_2O$ 7.5	P_s/P_m 1.0	206.Q.20-1	.626	WC-	0.84
T_m 90	T_s 1800		.627	$F_{blockage}$	
"C" Factor	K 35.95		.627	$C_{p,adj}$ ~~.84~~ .831	
Ref ΔP		$D_{n,avg}$ .6267		A_n .3085 in²	
Meter Box No. 2938		Dry Gas Meter Y_m 1.002		D_t 4.5 ft	A_t 15.904 ft²

Filter		Probe	
Type	Number	Length	Liner Material
Quartz	Z-1	5' eff	Quartz
		Probe Heat Setting 240°F	

OPERATIONAL CHECKS

Initial Leak Check		Initial Pitot Tube Leak Check
Vacuum (in. Hg)	Leak Rate	0.000/0.000 in. H_2O per 15 ~~Min.~~
15	0.007 ft³ per 1 Min.	at .22/.11 in. H_2O
Final Leak Check		**Final Pitot Tube Leak Check**
Vacuum (in. Hg)	Leak Rate	0.000/0.000 in. H_2O per 15 ~~Min.~~
4.8	0.009 ft³ per 1 Min.	at 2.4/2.3 in. H_2O
Gas Bag System Leak Check		**Component Leak Check**
Initial OK	Final OK	Vacuum (in Hg.) / Leak Rate
P_{bar} 26.11	P_{bar} ~~26.11~~ -.13	ft³ per Min.
Start Time 1355	End Time 1452	ft³ per Min.

35.93
Kp = ~~34.95~~

Point No.	θ (min)	V_m (ft³) 240.904	ΔP inches H_2O	$(\Delta P)^{1/2}$	ΔH inches H_2O	T_m (°F) t_i	t_f	T_s (°F)	Vacuum inches Hg	Final Imp. Temp. (°F)	Filter Temp. (°F)	Remarks Pulse Temp °F
1	5	243.24	.015	.12	.540	86	86	1772	2.0	55	236	238
2	10	245.66	.017	.130	.611	87	86	1763	2.0	52	242	240
3	15	248.32	.020	.141	.720	89	86	1824	2.0	52	247	241
4	20	251.07	.022	.148	.791	91	87	1835	2.0	52	250	246
5	25	253.87	.023	.152	.830	92	87	1844	2.0	53	251	238
6	30	256.70	.025	.158	.900	93	88	1842	2.1	55	252	244
7	35	260.25	.038	.195	1.370	94	88	1862	2.8	55	252	249
8	40	264.24	.050	.224	1.800	96	89	1880	3.8	58	251	243
9	45	268.32	.052	.228	1.870	97	91	1887	4.0	60	253	251
10	50	272.73	.066	.245	2.160	99	92	1893	4.5	54	250	253
11	55	277.22	.063	.251	2.265	101	93	1888	4.6	58	249	252
12	60	281.660	.060	.245	2.160	102	95	1895	4.5	61	247	236
		~~282.450~~										
13	5	285.03	.018	.134	.650	102	102	1857	2.0	62	241	229
14	10	287.41	.015	.122	.540	102	101	1656	2.0	56	244	231
15	15	290.07	.020	.141	.720	103	101	1796	2.0	54	245	239
16	20	292.60	.018	.134	.650	103	100	1811	2.0	55	250	235
17	25	295.32	.021	.145	.755	104	100	1750	2.0	54	254	237
18	30	298.16	.023	.152	.830	104	100	1771	2.1	53	254	244
19	35	301.38	.030	.173	1.080	105	101	1773	2.2	55	253	231
20	40	304.67	.032	179	1.15	105	101	1769	2.3	52	252	250
21	45	~~307.99~~ 304.67	033	182	1.19	106	101	1767	2.3	53	253	252
22	50	311.62	.040	.200	1.44	106	102	1760	3.0	51	252	238
23	55	315.36	.042	.205	1.51	105	102	1755	3.1	52	250	234
24	60	319.045	.040	.200	1.44	104	102	1758	3.0	52	249	240
TOTAL		77.351										
AVERAGE 1				0.1753	1.17	97.0 °F		1777.5°F				
						+460		+460				
AVERAGE 2						557 R		2237.5R				

PM10 Train Summary Data Calculations

Date: 10-26-94
Plant: HWAAP HGDS
Run No: 5

	DATA
Units, Metric(1) or English(2):	2
Barometric Pressure(mm Hg, in. Hg):	26.11
Stack Static Pressure(mm H2O, in. H2O):	-0.13
Stack Area(m^2, ft^2):	15.9043
Nozzle Diameter(mm, in.):	0.6267
Pitot Tube Coefficient, Cp:	0.831
DGM Calibration Factor, Y:	1.002
Initial DGM Reading(liters, dscf):	241.694
Final DGM Reading(liters, dscf):	319.045
Total Run Time(min):	120

FILTER, NOZZLE RINSE, AND MOISTURE DATA

	DATA
Dry Molecular Weight of Stack Gas:	28.7660435
Particulate Mass in Probe Rinse(mg):	10.35
Particulate Mass in Filter Catch(mg):	2.48
Water Vapor Condensed in Impingers(ml):	91.2
Water Vapor Collected in Silica Gel(g):	23.7
% CO2	7.60%
% O2	11.40%
% N2	81.00%
% CO	0.00%

RESULTS

Average DGM Temperature(K, R):	557.042
Average Orifice Press. Drop(mm H2O, in. H2O):	1.166
Standard Dry Gas Volume, Vm(std)(dscm, dscf):	64.295
Stack Gas Velocity(m/s, f/s):	21.819
Standard Volumetric Flow Rate(dscmm, dscfm):	3953.351
Standard Volumetric Flow Rate(dscmh,dscfh):	237201.032
Volume of Water Vapor(scm, scf):	5.410
Moisture Content(%):	7.762
Isokinetics:	100.682

FIELD DATA SHEET	RUN NO. M202 - 3 (7)	DATE 10-29-94

GENERAL

Project Number	Installation Hawthorne AAP	Meter Box Operator D Keesee
Sample Location	HGD System	
Type of Sample:	Acid Mist POHC Metals Moisture (Particulate)	
	SO_2 SO_3 SO_x Particle Size Other:	

EQUIPMENT SPECIFICATIONS

Nomograph/Calculator		Nozzle		Pitot Tube	
$\Delta H_@$ 1.82	ΔP_{avg} 0.0323	No.	D_n	No.	C_p
$\%H_2O$ 7.5	P_s/P_m 1.0	206.Q.20-2	.635	WC-	0.84
T_m 90	T_s 1800		.635	$F_{blockage}$	
"C" Factor	K 37.8		.634	$C_{p,adj}$ ~~.827~~ .831	
Ref ΔP		$D_{n,avg}$ .6346		A_n 2142 E-3	
Meter Box No. 2928		Dry Gas Meter Y_m		D_t 4.5"	A_t 15.904

Filter		Probe	
Type	Number	Length	Liner Material
Quartz	Z-6	5' eff	Quartz
		Probe Heat Setting	

OPERATIONAL CHECKS

Initial Leak Check		Initial Pitot Tube Leak Check
Vacuum (in. Hg)	Leak Rate	0.000/0.000 in. H_2O per 15 Min.
15	0.0002 ft³ per 1 Min.	at 1.9/2.2 in. H_2O
Final Leak Check	0.0005	Final Pitot Tube Leak Check
Vacuum (in. Hg)	Leak Rate	0.000/0.000 in. H_2O per 15 Min.
6.8	0.006 ft³ per 1 Min.	at 1.9/2.2 in. H_2O
Gas Bag System Leak Check		Component Leak Check
Initial OK	Final OK	Vacuum (in Hg.) / Leak Rate
P_{bw}	P_{aw} -.135	ft³ per Min.
Start Time 1097	End Time 1325	ft³ per Min.

$K_p = 378$

.nt	θ (min)	V_m (ft^3) 392600	ΔP inches H_2O	$(\Delta P)^{1/2}$	ΔH inches H_2O	T_m (°F) t_i	t_f	T_s (°F)	Vacuum inches Hg	Final Imp. Temp. (°F)	Filter Temp. (°F)	Remarks Probe Temp °F
1	5	395.06	.015	.122	.570	58	56	1648	2.0	56	236	229
2	10	397.06	.025	.158	945	60	57	1678	2.2	52	238	231
3	15	400.53	.018	.134	1.890	63	58	1716	2.0	51	245	241
4	20	403.18	.020	.141	.756	65	59	1737	2.0	54	252	236
5	25	405.90	.021	.145	.794	66	60	1743	2.1	56	250	232
6	30	408.17	.022	.148	.832	67	60	1746	2.1	54	244	248
7	35	411.05	.035	187	1.323	68	62	1722	3.0	55	247	253
8	40	416.07	.048	.219	1.810	69	63	1715	4.0	55	250	249
9	45	420.23	.056	.235	2.080	70	63	1686	4.8	57	252	252
10	50	424.80	.065	.255	2.460	70	64	1682	6.0	55	254	255
11	55	429.58	.070	265	2.650	71	65	1684	6.5	58	254	258
12	60	434.440	.072	.269	2.772	72	66	1701	6.8	60	253	259
		435.202										
13	5	437.59	.015	.122	.570	73	71	1804	2.0	51	230	231
14	10	440.15	.018	.134	680	74	71	1801	2.0	47	232	236
15	15	442.84	.020	.141	756	77	72	1762	2.1	45	249	230
16	20	445.71	.023	.152	.890	79	73	1803	2.2	45	246	231
17	25	448.50	.022	.148	.832	81	74	1812	2.1	45	239	247
18	30	451.49	.025	.158	.945	82	76	1813	2.2	46	248	248
19	35	454.73	.030	173	.134	82	76	1801	2.8	45	246	240
20	40	458.18	.035	.187	1.323	84	78	1794	3.0	48	254	250
21	45	462.03	.045	.212	1.700	84	79	1782	3.8	49	254	256
22	50	465.95	.043	.207	1.625	84	79	1778	3.8	49	255	249
23	55	469.74	.045	212	1.700	85	80	1768	4.0	49	255	248
24	60	473.570	.042	.205	1.588	85	80	1773	3.9	49	256	243
TOTAL		77.77		.180	1.307							
AVERAGE 1		.158				71.1 °F		1748 °F				
		.152				+460		+460				
AVERAGE 2						531.1 R		2208 R				

PM10 Train Summary Data Calculations

Date: 10-29-94
Plant: HWAAP HGDS
Run No: 7

	DATA
Units, Metric(1) or English(2):	2
Barometric Pressure(mm Hg, in. Hg):	26.2
Stack Static Pressure(mm H2O, in. H2O):	-0.135
Stack Area(m^2, ft^2):	15.9043
Nozzle Diameter(mm, in.):	0.6346
Pitot Tube Coefficient, Cp:	0.831
DGM Calibration Factor, Y:	1.002
Initial DGM Reading(liters, dscf):	393.362
Final DGM Reading(liters, dscf):	473.52
Total Run Time(min):	120

FILTER, NOZZLE RINSE, AND MOISTURE DATA

	DATA
Dry Molecular Weight of Stack Gas:	28.8300375
Particulate Mass in Probe Rinse(mg):	15.15
Particulate Mass in Filter Catch(mg):	9.25
Water Vapor Condensed in Impingers(ml):	94.7
Water Vapor Collected in Silica Gel(g):	26.6
% CO2	8.00%
% O2	10.80%
% N2	81.20%
% CO	0.00%

RESULTS

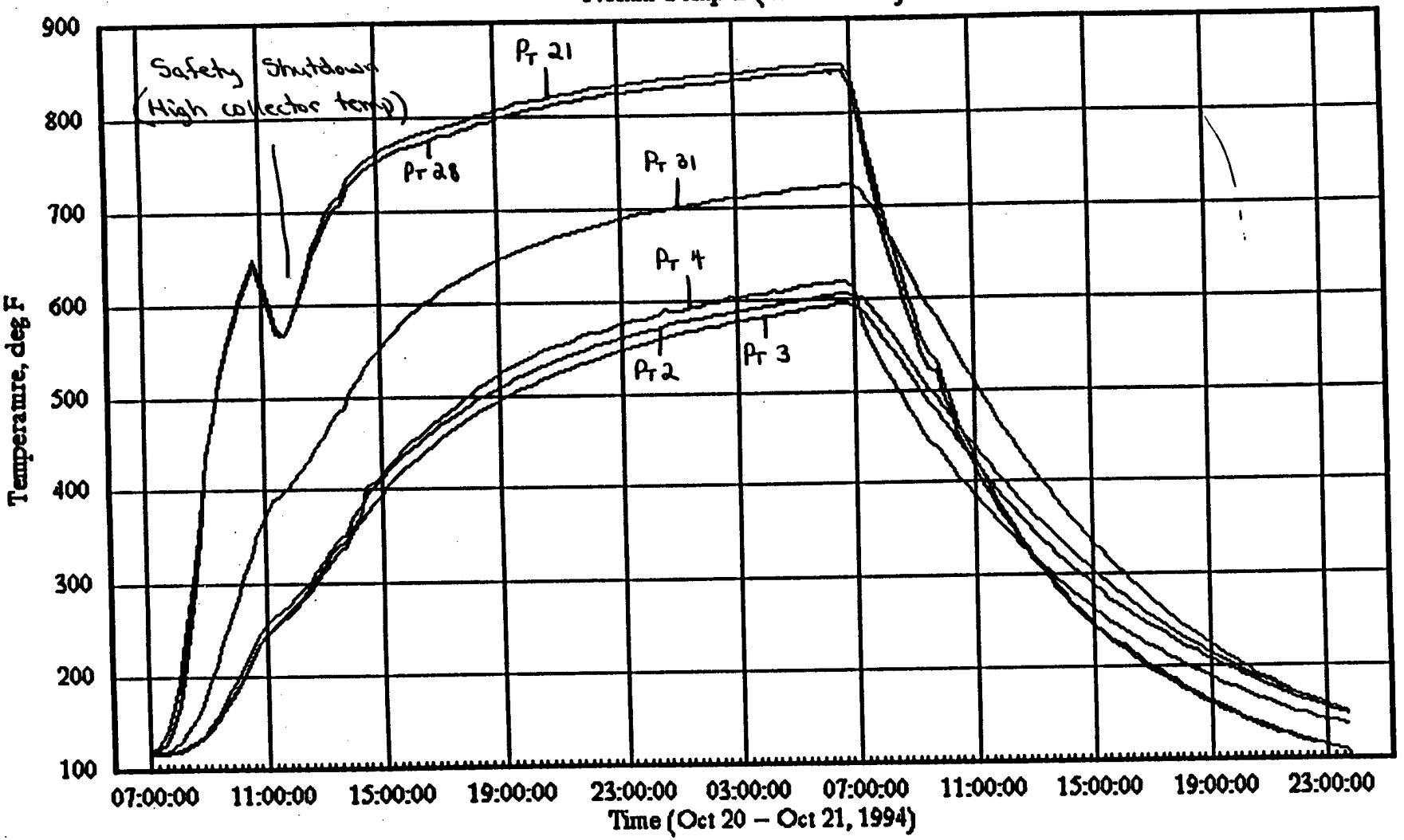
Average DGM Temperature(K, R):	531.188
Average Orifice Press. Drop(mm H2O, in. H2O):	1.307
Standard Dry Gas Volume, Vm(std)(dscm, dscf):	70.139
Stack Gas Velocity(m/s, f/s):	22.239
Standard Volumetric Flow Rate(dscmm, dscfm):	4107.879
Standard Volumetric Flow Rate(dscmh,dscfh):	246472.711
Volume of Water Vapor(scm, scf):	5.712
Moisture Content(%):	7.530
Isokinetics:	103.086

APPENDIX J

PROCESS DATA GRAPHS

HGD Test 31

175mm Comp B (480 Rounds)



592°F/311

____ Pt 2 (adjacent to process probe) ____ Pt 3 (coldest) 581/305 ____ Pt 4 (late peak) 606/319

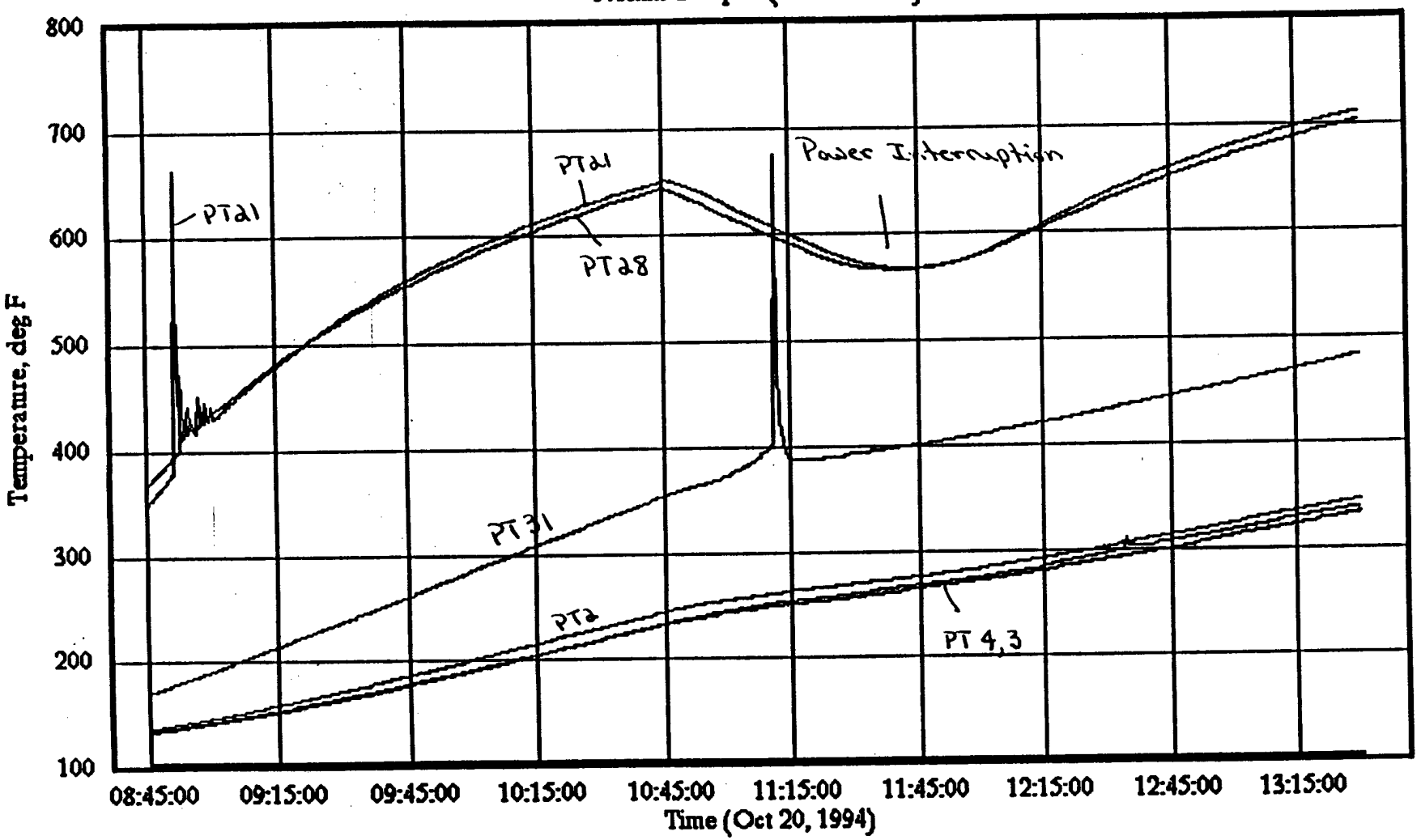
____ Pt 31 (intermediate peak) 714/379 ____ Pt 21 (hottest) 846/452 ____ Pt 28 (early peak) 838/448

J-2

15 min.
A-3/a

HGD Test 31

175mm Comp B (480 Rounds)



____ Pt 2 (adjacent to process probe) ____ Pt 3 (coldest) ____ Pt 4 (late peak)

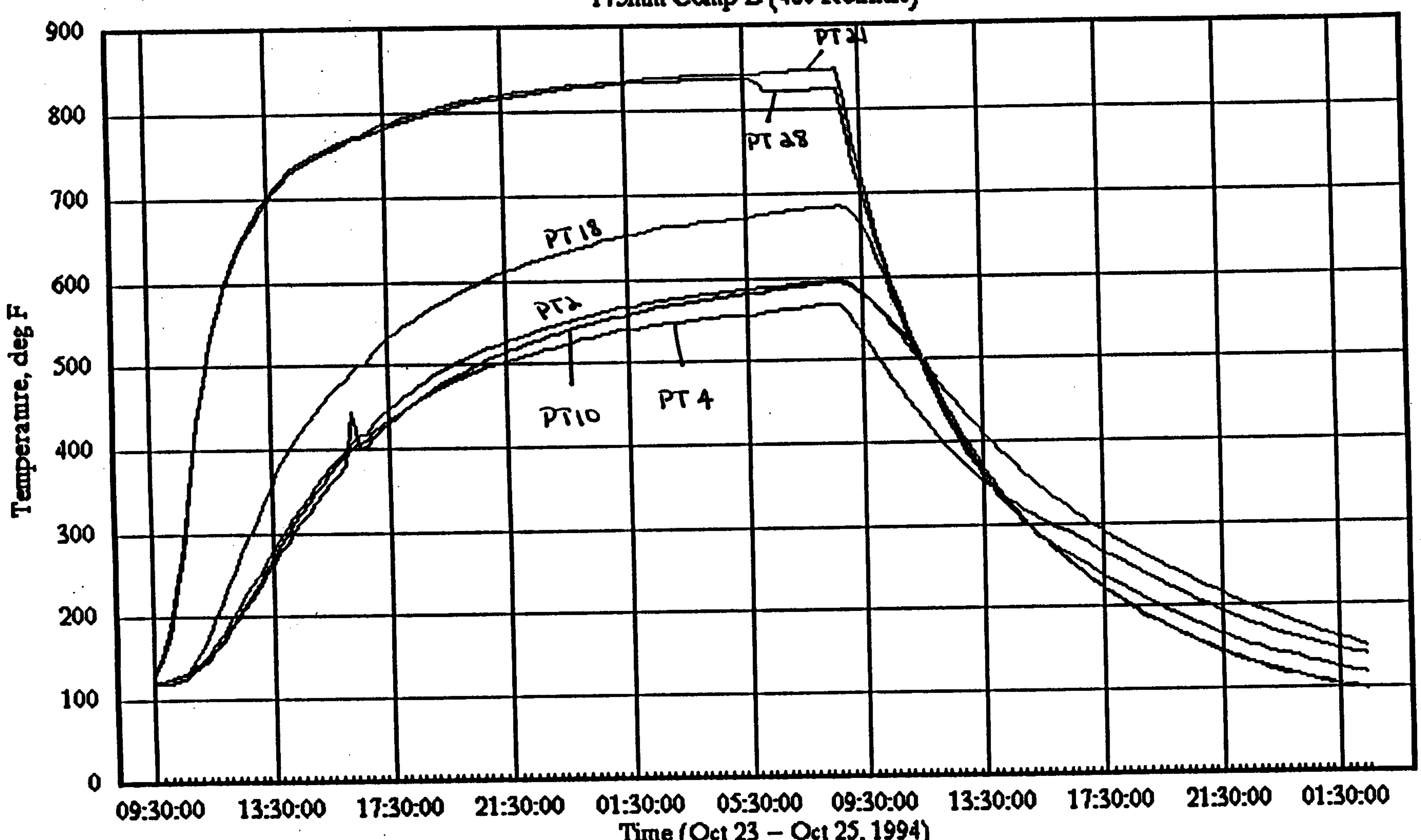
____ Pt 31 (intermediate peak) ____ Pt 21 (hottest) ____ Pt 28 (early peak)

J-3

15 pp
G-31b

HGD Test 32

175mm Comp B (480 Rounds)

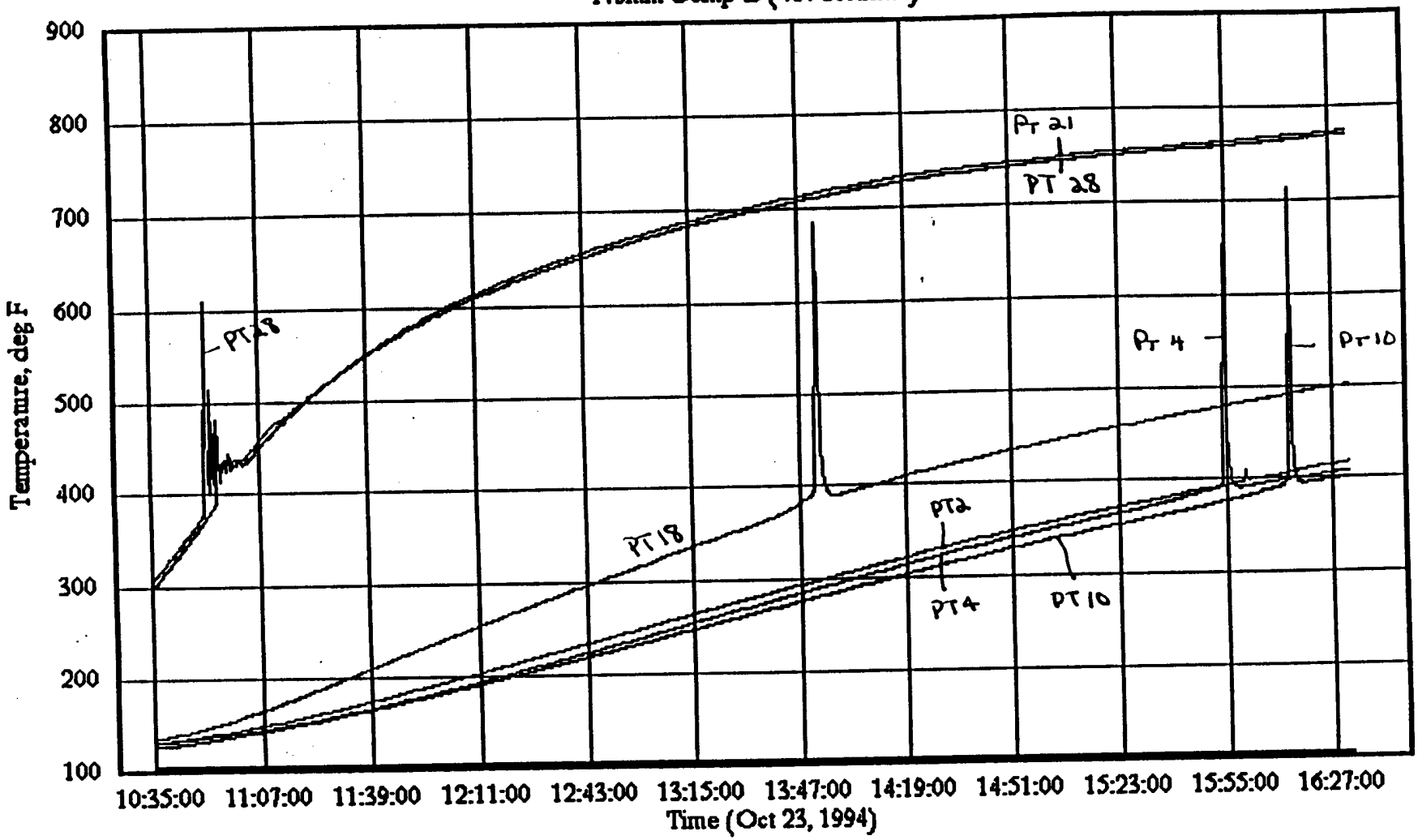


- Pt 2 (adjacent to process probe) 587/ 308°C
- Pt 4 (coldest) 557/ 292
- Pt 10 (late peak) 582/ 306
- Pt 18 (intermediate peak) 673/ 356
- Pt 21 (hottest) 844/ 451
- Pt 28 (early peak) 831/ 444

15 min
G-32 b

HGD Test 32

175mm Comp B (480 Rounds)



____ Pt 2 (adjacent to process probe)

____ Pt 4 (coldest)

____ Pt 10 (late peak)

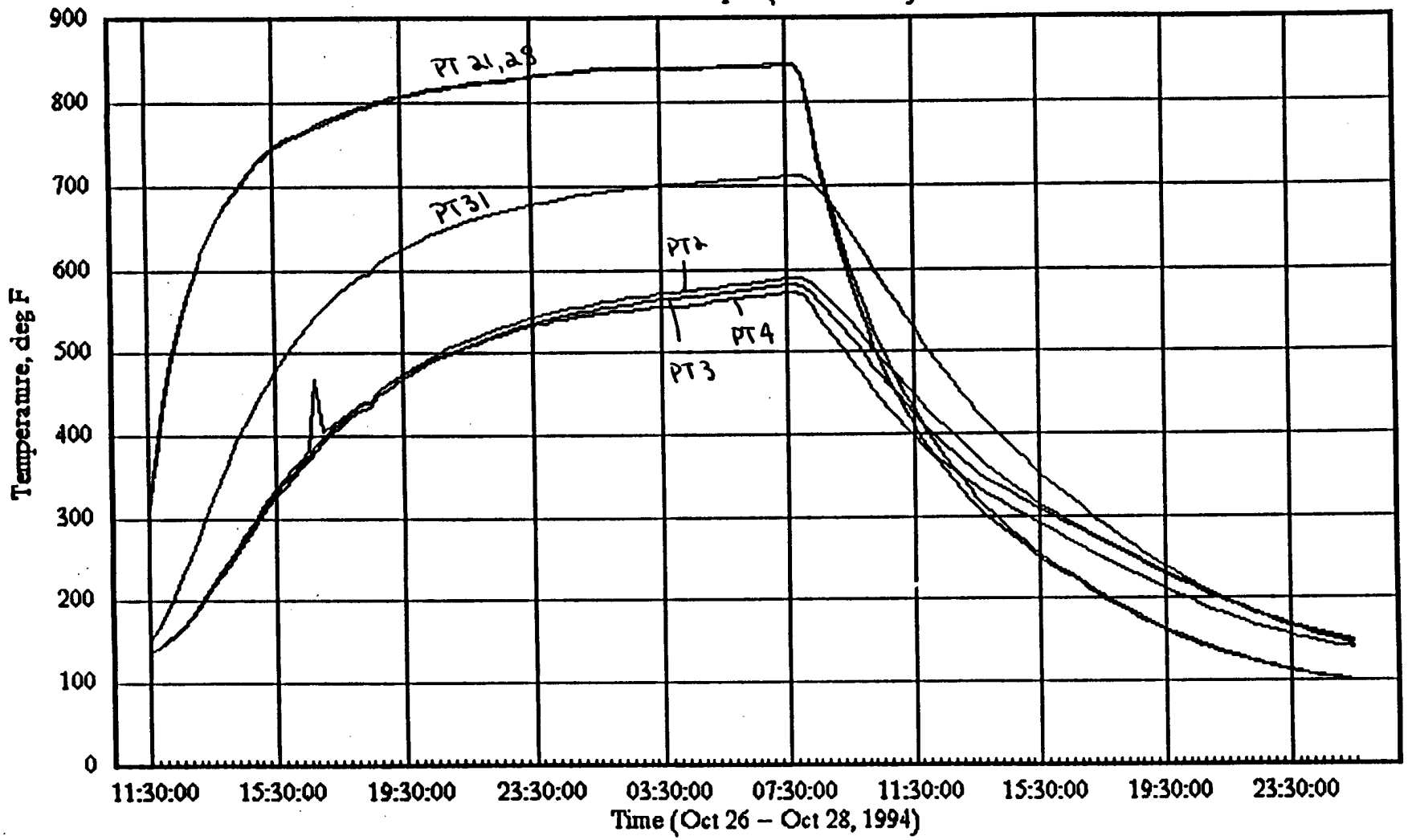
____ Pt 18 (intermediate peak)

____ Pt 21 (hottest)

____ Pt 28 (early peak)

HGD Test 33

175mm Comp B (480 Rounds)



577/ 303°C

___ Pt 2 (adjacent to process probe)

___ Pt 3 (coldest) 569 /298

___ Pt 4 (late peak) 560/ 293

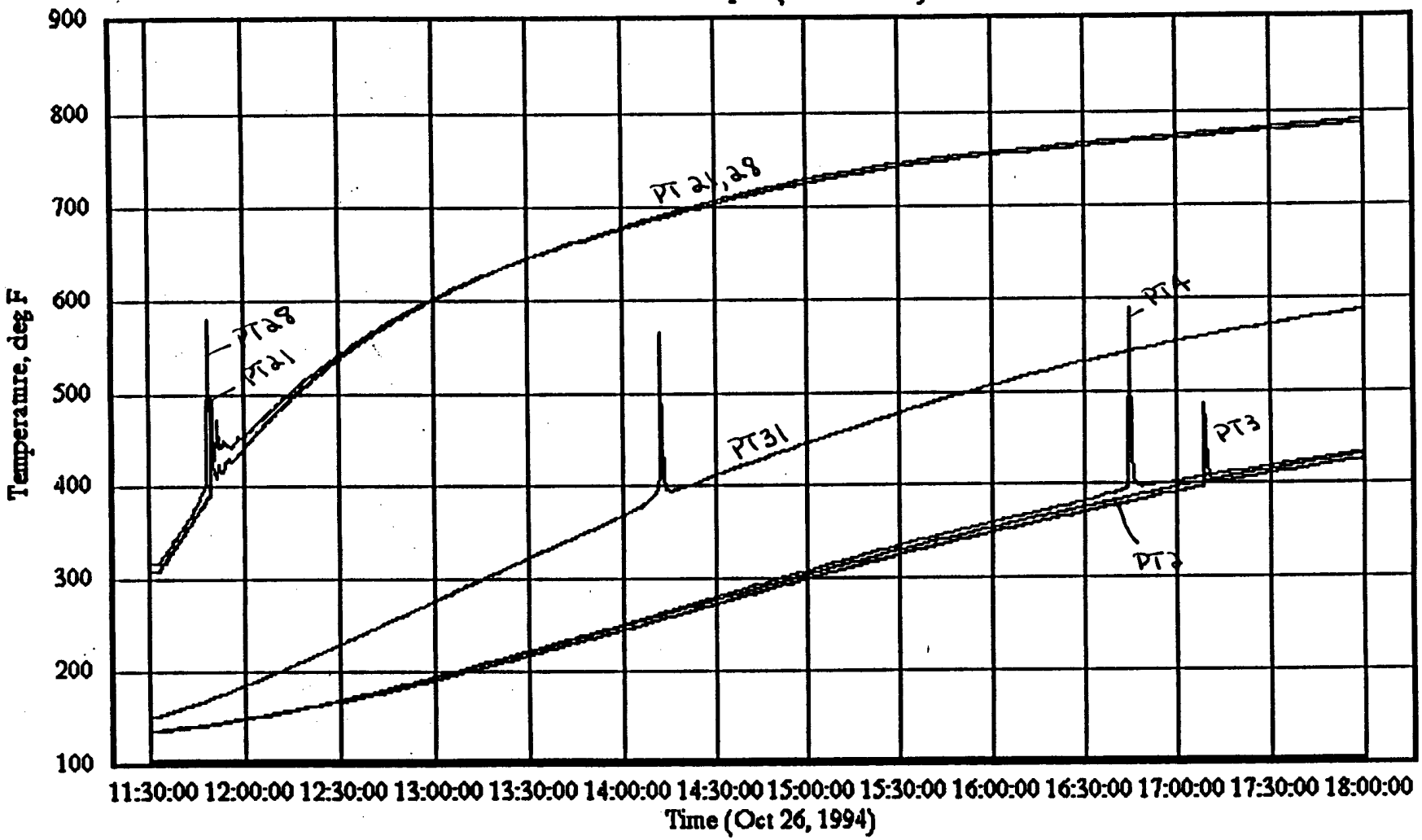
___ Pt 31 (intermediate peak) 704/ 373

___ Pt 21 (hottest) 849/451

___ Pt 28 (early peak) 841/ 449

HGD Test 33

175mm Comp B (480 Rounds)



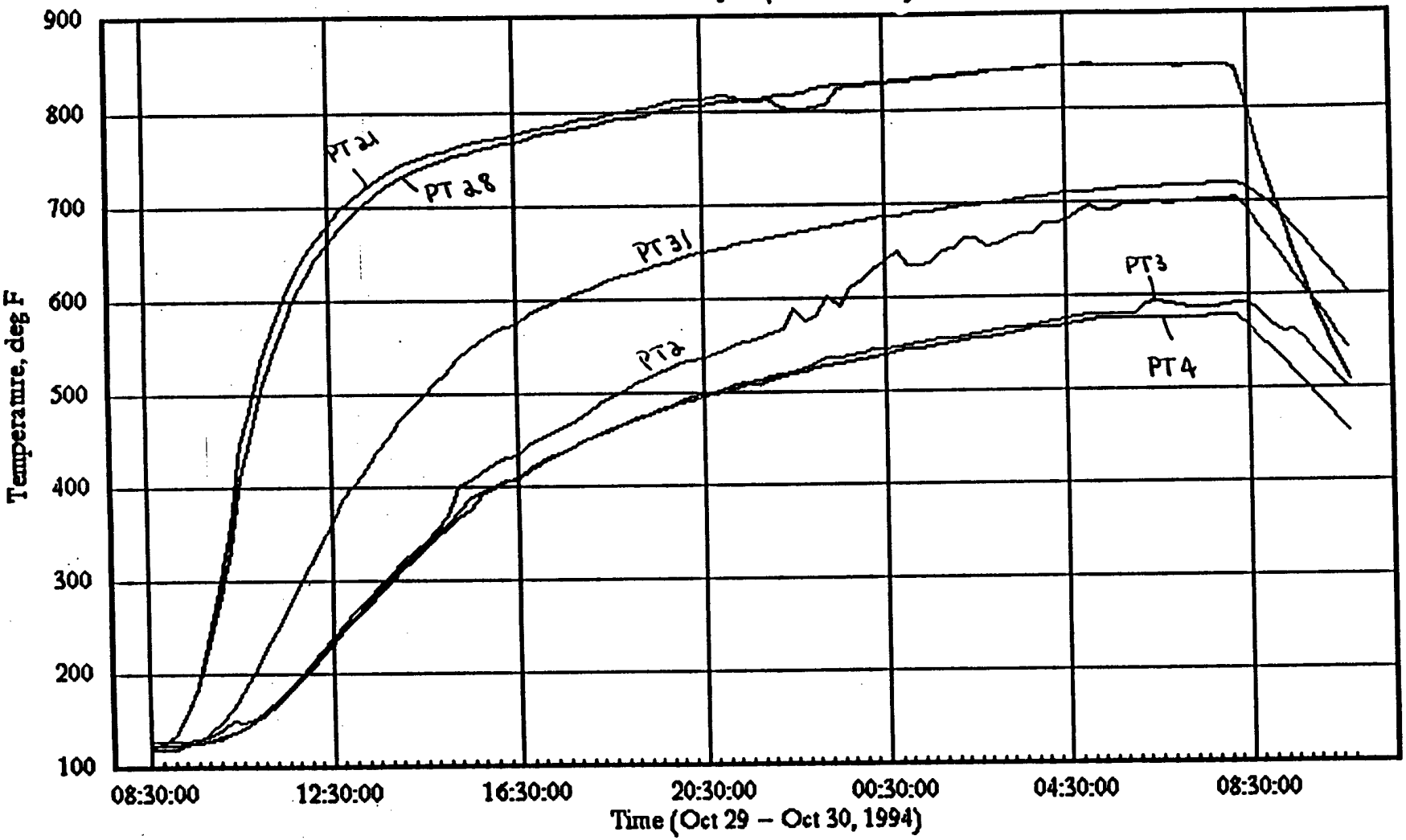
____ Pt 2 (adjacent to process probe) ____ Pt 3 (coldest) ____ Pt 4 (late peak)

____ Pt 31 (intermediate peak) ____ Pt 21 (hottest) ____ Pt 28 (early peak)

18 sec
(1-33b

HGD Test 34

175mm Comp B (480 Rounds)



696°F / 363°C
518°/ 303

____ Pt 2 (adjacent to process probe) ____ Pt 3 (coldest) ____ Pt 4 (late peak) 570/ 299

____ Pt 31 (intermediate peak) ____ Pt 21 (hottest) ____ Pt 28 (early peak)

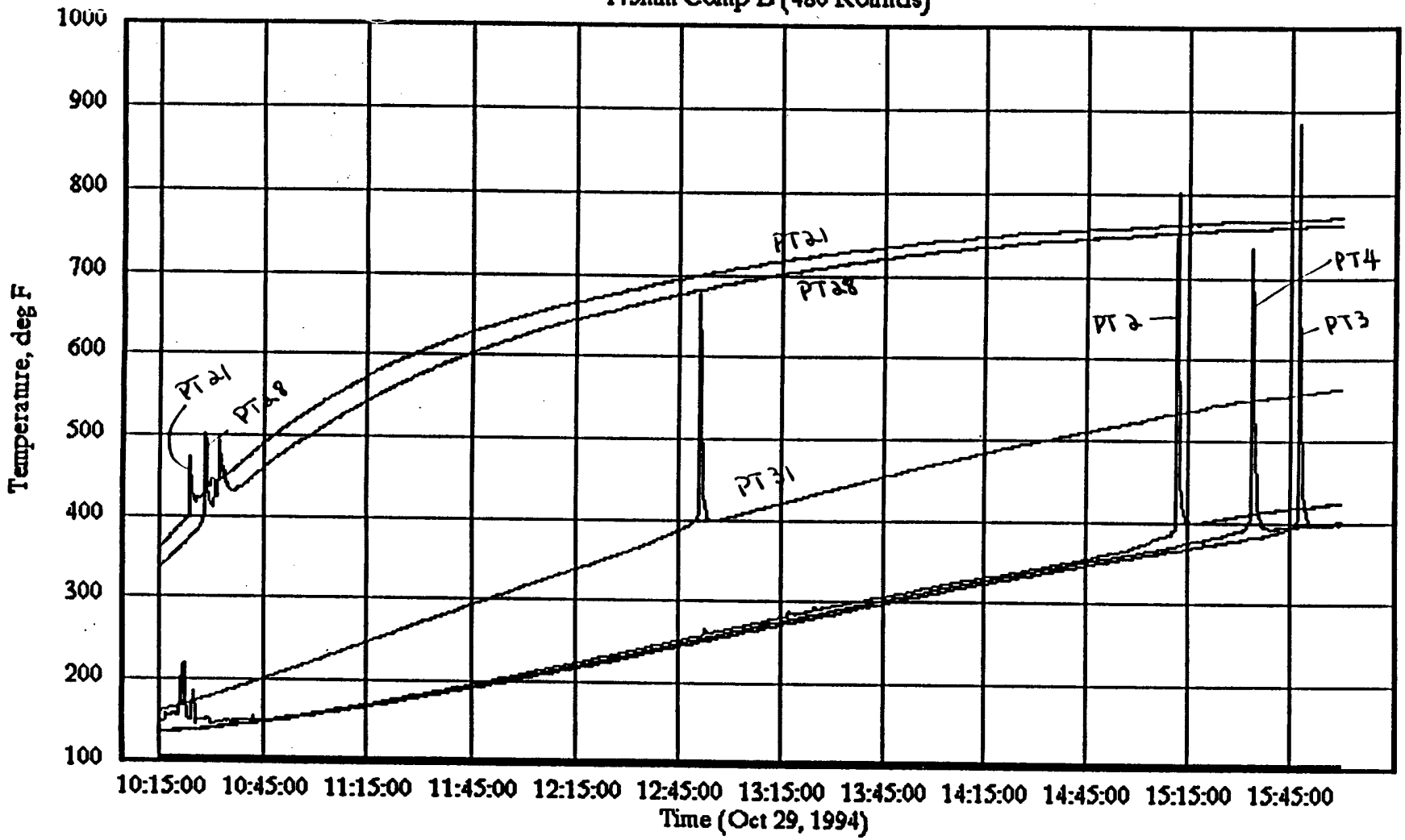
711/377 845/452 845/452

J-8

15 min
G.342

HGD Test 34

175mm Comp B (480 Rounds)



Pt 2 (adjacent to process probe)

Pt 3 (coldest)

Pt 4 (late peak)

Pt 31 (intermediate peak)

Pt 21 (hottest)

Pt 28 (early peak)

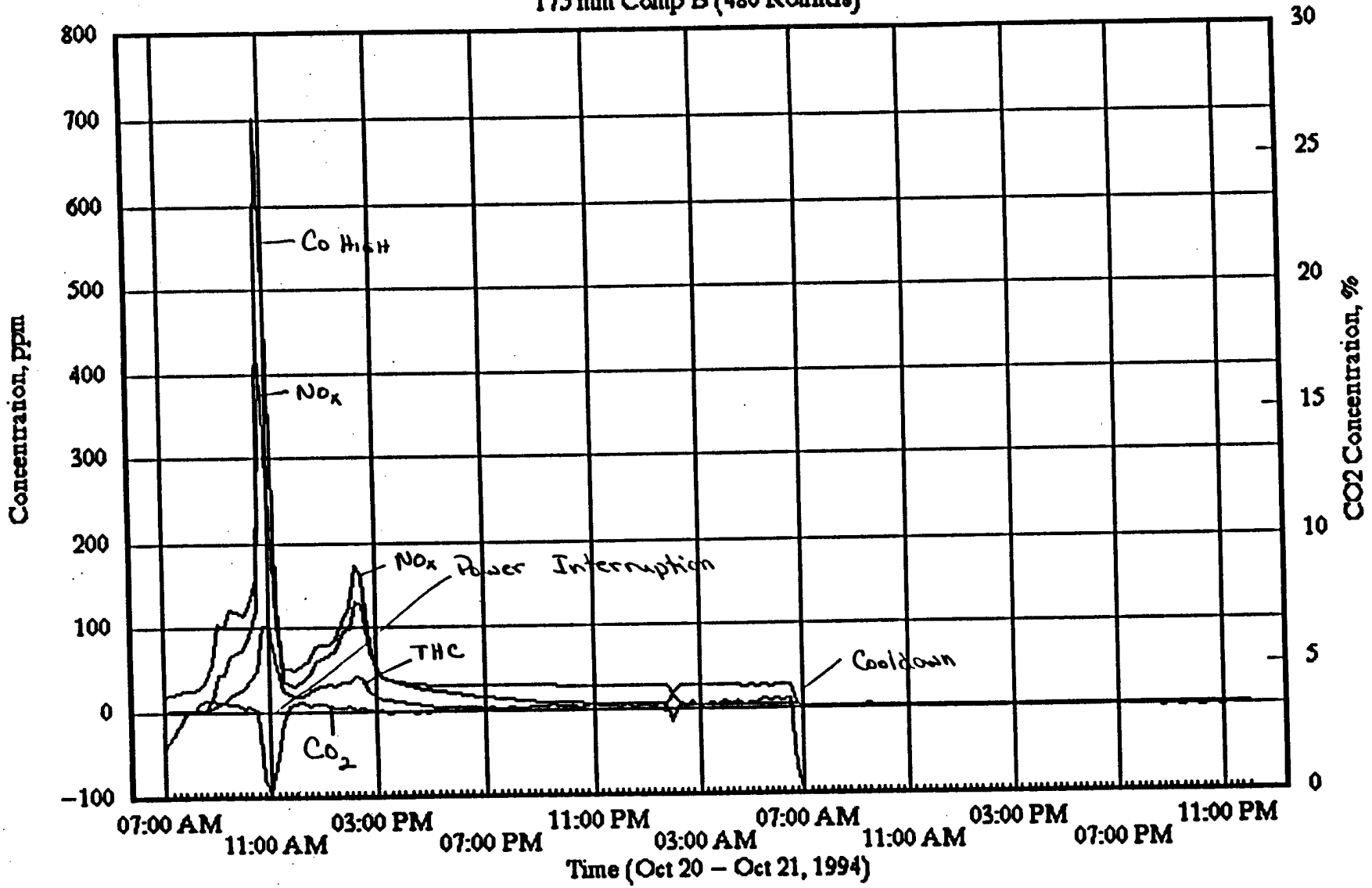
15 sec

APPENDIX K

PROCESS CONTINUOUS EMISSION MONITORS DATA GRAPHS

HGD Test 31

175 mm Comp B (480 Rounds)

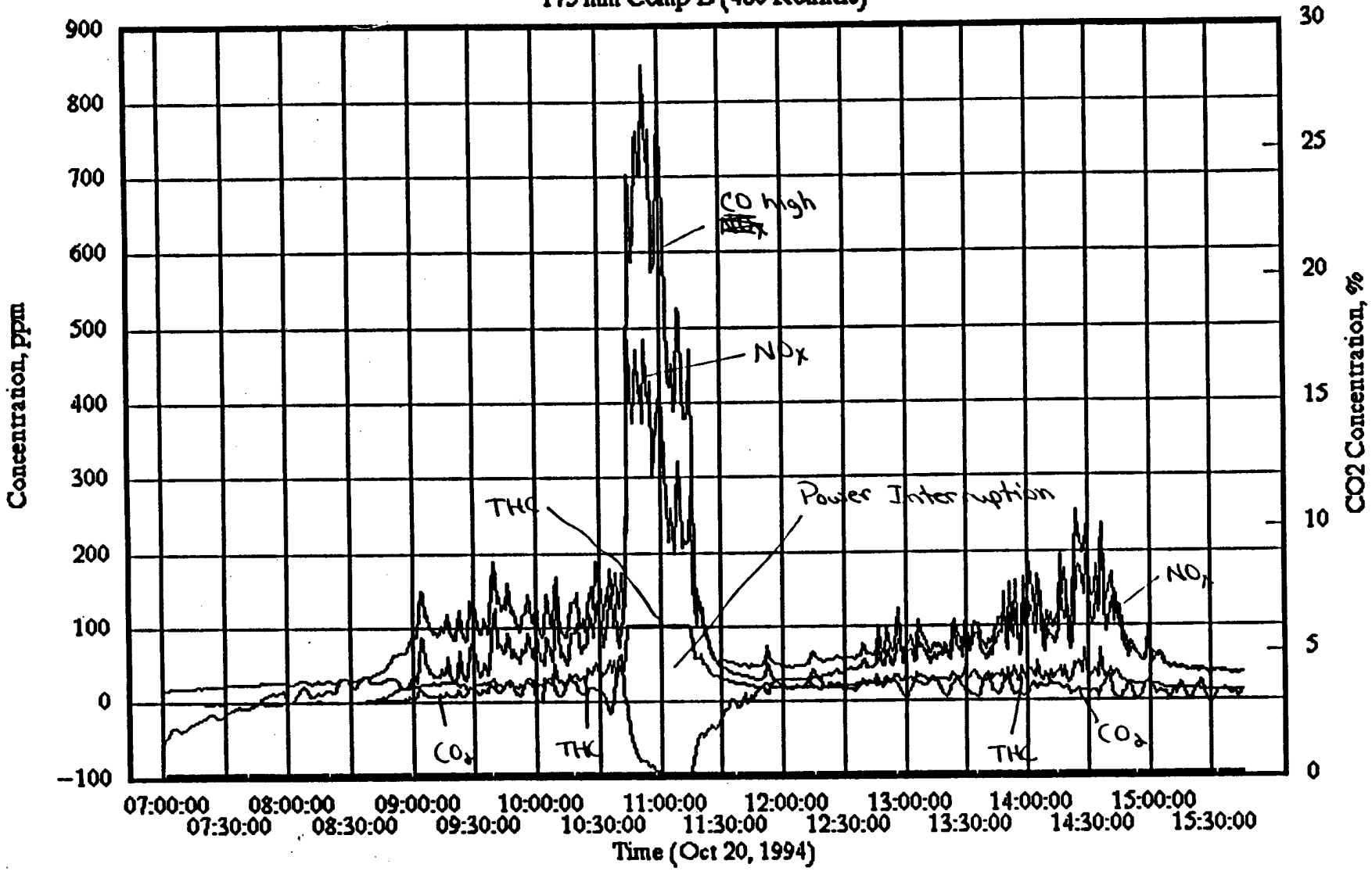


K-2

15 mm
Fig. 7.1c

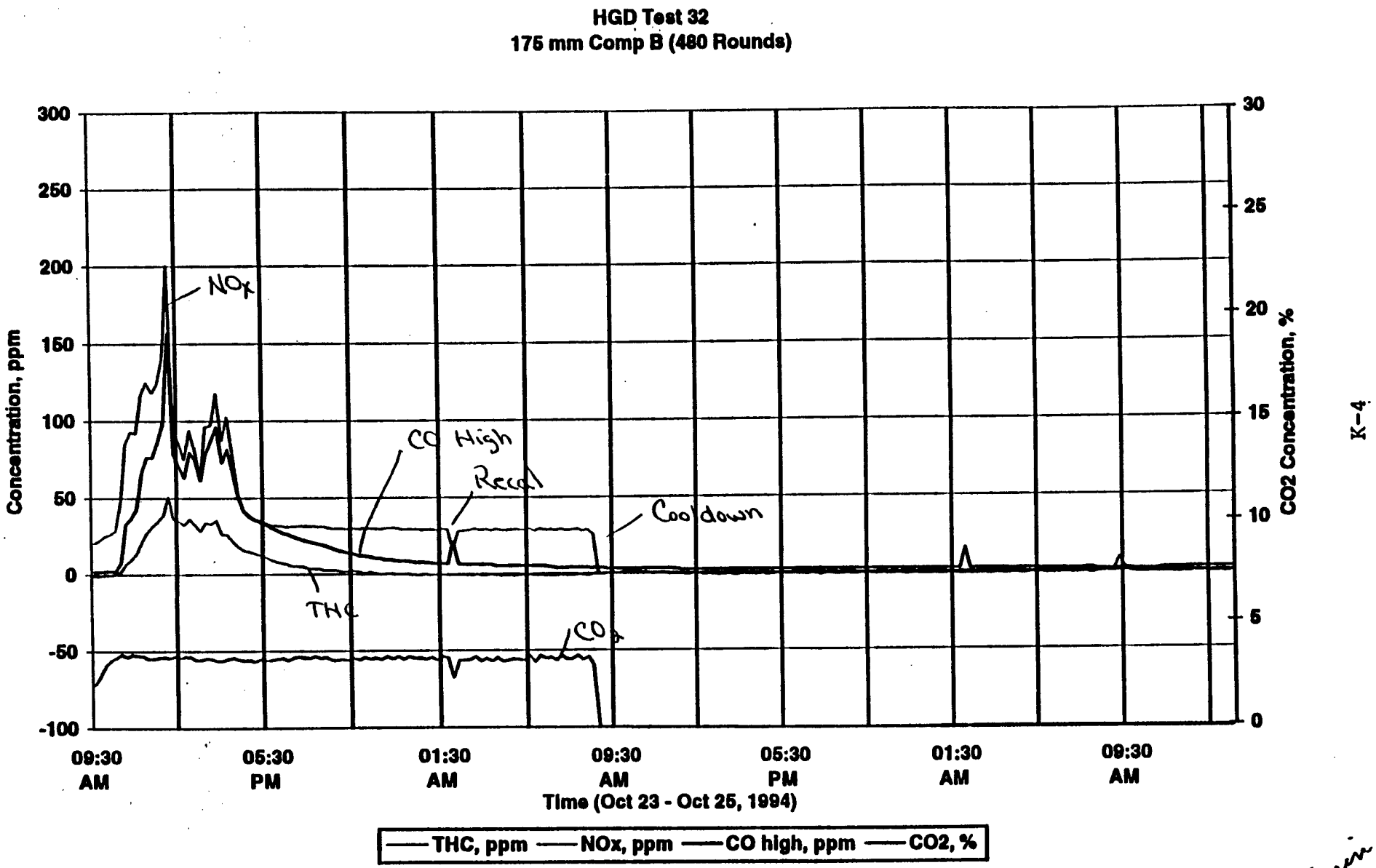
HGD Test 31

175 mm Comp B (480 Rounds)



K-3

1 min
G-31d

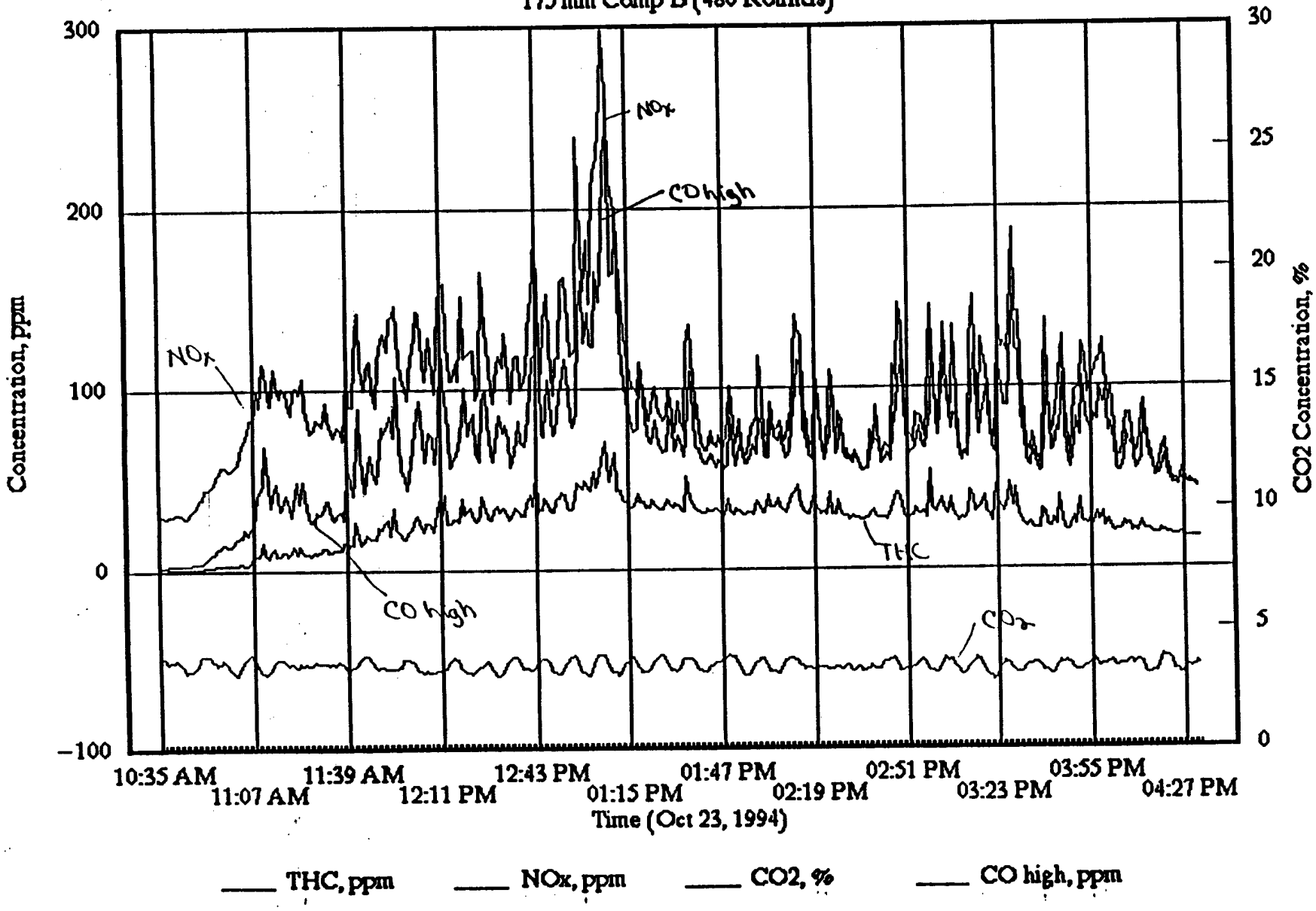

HGD Test 32
175 mm Comp B (480 Rounds)
Concentration, ppm
CO2 Concentration, %
300
250
200
150
100
50
0
-50
-100
30
25
20
15
10
5
0
NOx
CO High
Recal
Cooldown
THC
CO
09:30 AM
05:30 PM
01:30 AM
09:30 AM
05:30 PM
01:30 AM
09:30 AM
Time (Oct 23 - Oct 25, 1994)
THC, ppm
NOx, ppm
CO high, ppm
CO2, %

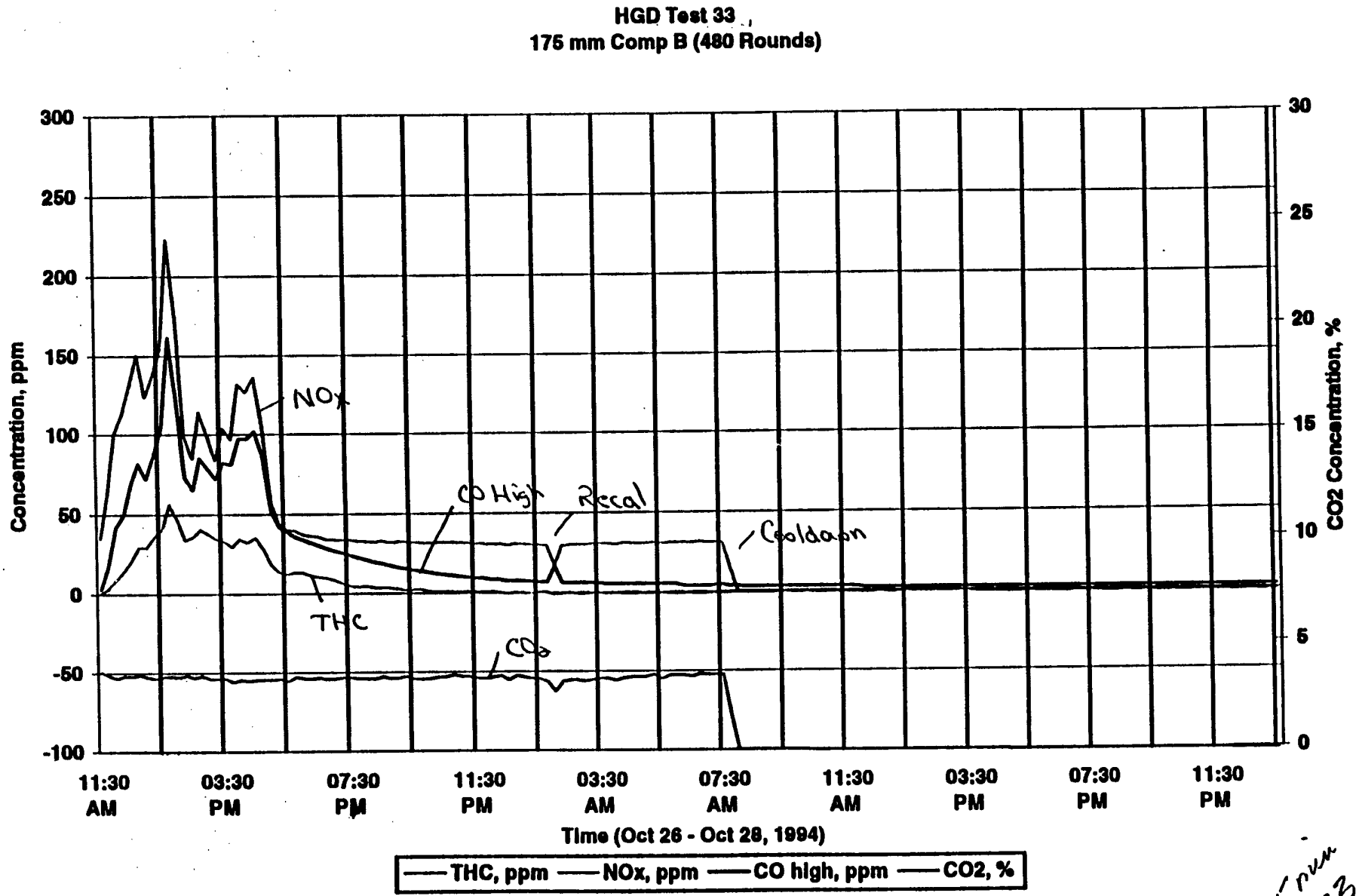
K-4

15 min
(1.37

HGD Test 32

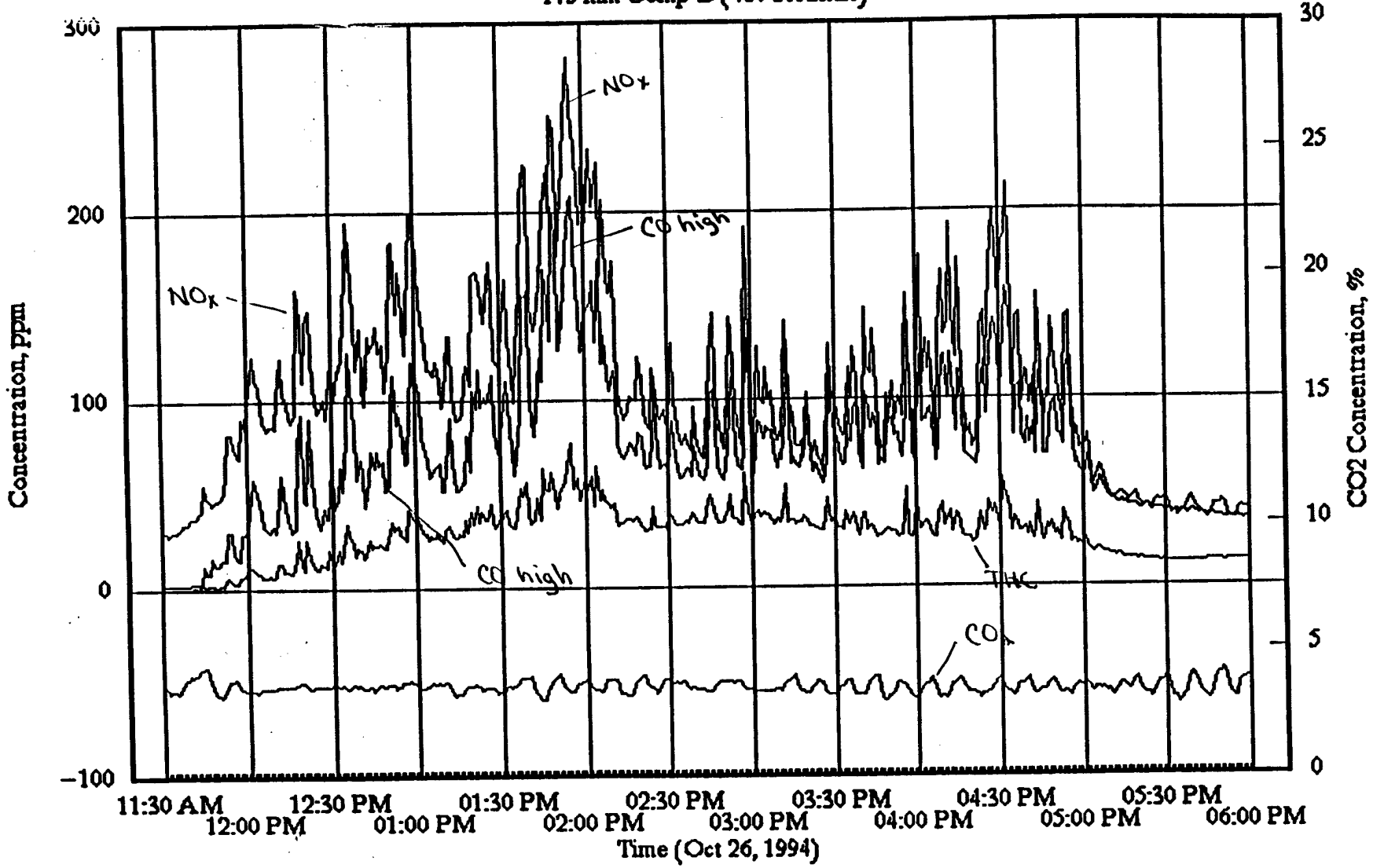
175 mm Comp B (480 Rounds)




HGD Test 33
175 mm Comp B (480 Rounds)
Concentration, ppm
CO2 Concentration, %
300
250
200
150
100
50
0
-50
-100
30
25
20
15
10
5
0
NOx
CO High
Recal
Cooldown
THC
CO
11:30 AM
03:30 PM
07:30 PM
11:30 PM
03:30 AM
07:30 AM
11:30 AM
03:30 PM
07:30 PM
11:30 PM
Time (Oct 26 - Oct 28, 1994)
THC, ppm
NOx, ppm
CO high, ppm
CO2, %

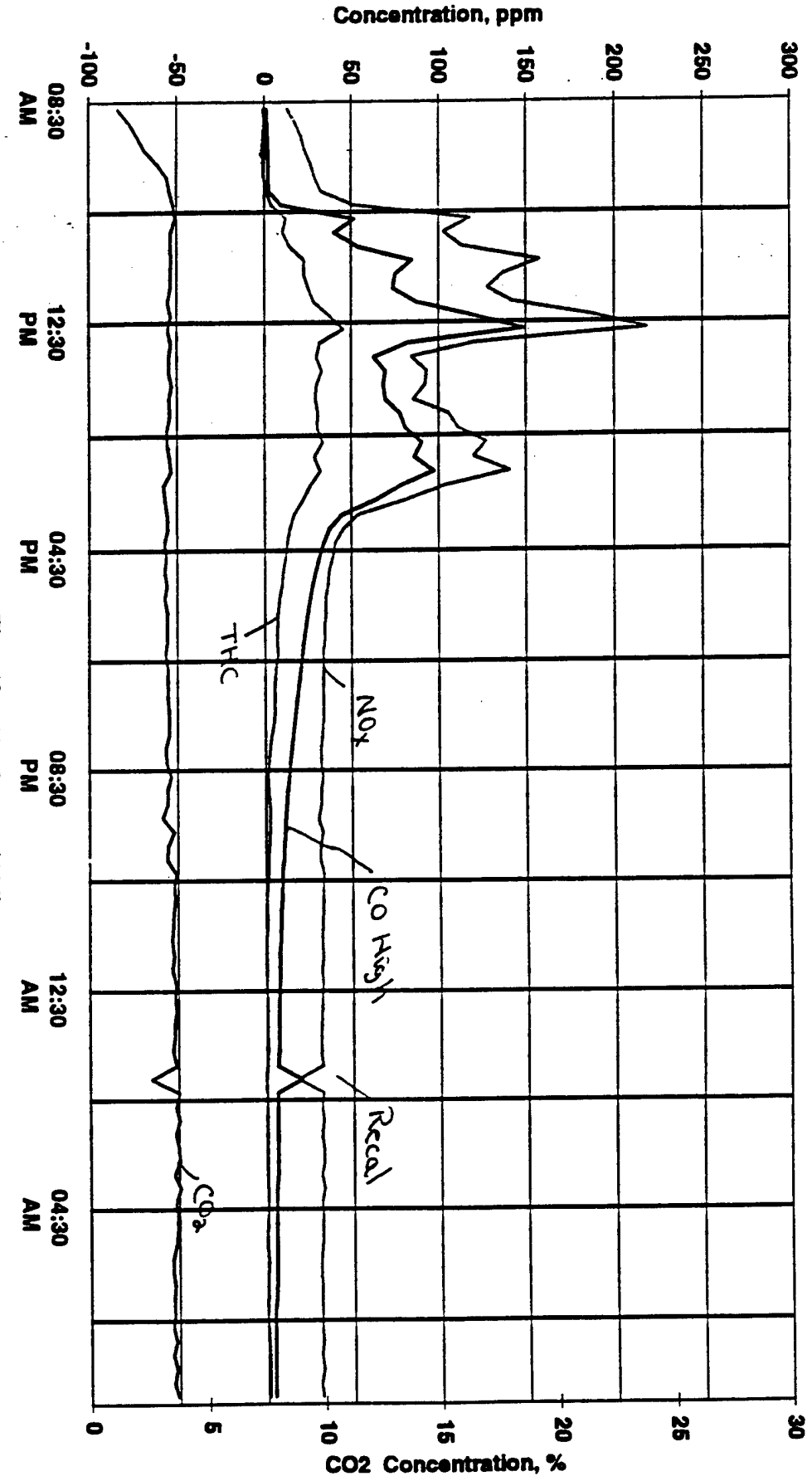
HGD Test 33

175 mm Comp B (480 Rounds)



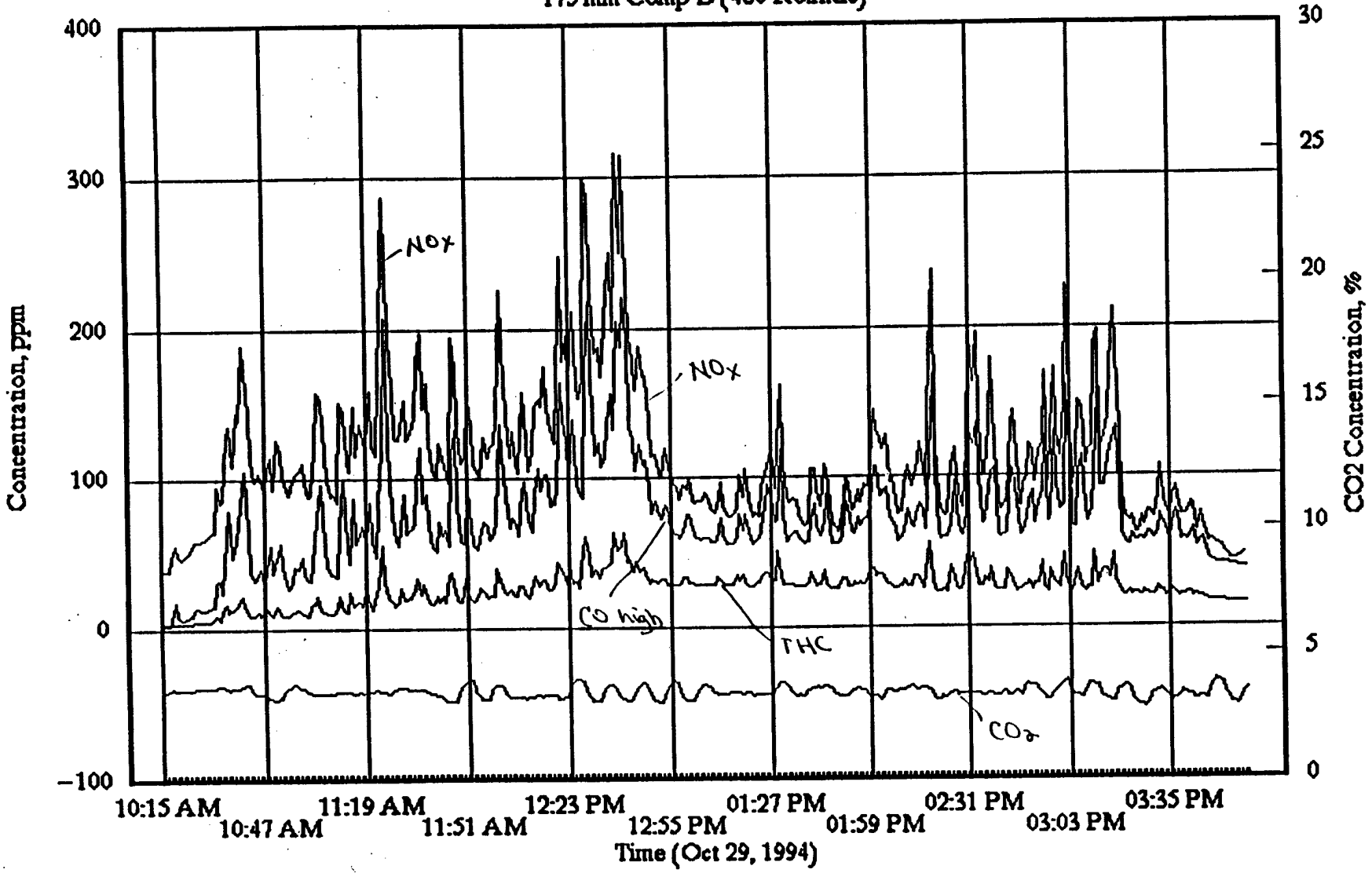
K-7

1 min
G-33d


HGD Test 34
175 mm Comp B (480 Rounds)
Concentration, ppm
-100
-50
0
50
100
150
200
250
300
08:30 AM
12:30 PM
04:30 PM
08:30 PM
12:30 AM
04:30 AM
Time (Oct 29 - Oct 30, 1994)
THC
NOx
CO High
Recal
CO2
0
5
10
15
20
25
30
CO2 Concentration, %
THC, ppm
NOx, ppm
CO high, ppm
CO2, %

HGD Test 34

175 mm Comp B (480 Rounds)



1 new G-34d

APPENDIX L

PM_{10} DATA SUMMARY

TABLE L-1 SUMMARY OF HGD SYSTEM AVERAGE EMISSIONS DURING EACH PM_{10} TEST

DATE		RUN 3 10/23/94	RUN 5 10/26/94	RUN 7 10/29/94
FEED DATA				
Average Batch Feed 175mm COMP B Proj	(No.)	480	480	480
	(lb/ea)	115	115	115
	(tons)*	27.6	27.6	27.6
STACK GAS DATA				
CO_2 Concentration (%, dry)		7.8	7.6	8.0
O_2 Concentration (%, dry)		10.6	11.4	10.8
CO Concentration (%, dry)		0.0	0.0	0.0
N_2 Concentration (%, dry)		81.6	81.0	81.2
Stack Gas Moisture Content (%)		6.12	7.76	7.53
Stack Gas Molecular Weight (lb/lb-mole, wet)		28.96	28.77	28.83
SAMPLING EQUIPMENT DATA				
Dry Gas Volume (dscf)		62.722	64.295	70.139
Total Sampling Time (min)		120	120	120
Isokinetic Sampling Rate (%)		103.75	100.68	103.09
Volumetric Flow Rate (dscf/hr)		224552	237201	246473
EMISSION DATA				
Particulate Collected, Front Half (mg)		31.63	12.83	24.40
Front Half Blank Correction (mg)		0.45	0.45	0.45
Organic CPM Collected, Back Half (mg)		13.50	5.40	23.76
Back Half $MeCl_2$ Blank Correction (mg)		0.80	0.80	0.80
Total Particulate Collected (mg)		43.88	16.98	46.91
PM_{10} Emission Rate†	(lb/hr)	0.346	0.138	0.363
	(tons/yr)	1.517	0.605	1.592

* Batch feed rate exceeds previous limit of 25 tons.
† Water fraction inadvertanly discarded during inorganic CPM analysis.

Run 3:

$$W_{PM_{10}} = \frac{43.88}{453.593} \times \frac{224,552}{62.722}$$

$$= 0.346 \text{ lb/hr}$$

Run 5:

$$W_{PM_{10}} = \frac{16.98}{453.593} \times \frac{237,201}{64.295}$$

$$= 0.138 \text{ lb/hr}$$

Run 7:

$$W_{PM_{10}} = \frac{46.91}{453.593} \times \frac{246,473}{70.139}$$

$$= 0.363 \text{ lb/hr}$$

APPENDIX M

CONTINUOUS EMISSION MONITOR CALIBRATION DATA SUMMARY

HWAAP Monitor Calibration Data:

THC Span =	60.00 ppmv
NOx Span =	250.00 ppmv
CO Span =	100.00 ppmv
SO2 Span =	175.00 ppmv

Run # 1

THC	Calibration Gas Conc.	Precalibration Response	3.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
	53.80	52.98	1.37%	53.80	NA	0.00%	
	24.88	23.80	1.80%	24.88	24.12	1.27%	
	8.05	8.06	0.02%	8.05	NA	0.00%	
	0.00	-0.05	0.08%	0.00	-0.18	0.30%	

NOx	Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
	225.80	225.20	0.24%	225.80	NA	0.00%	
	137.30	138.50	0.48%	137.30	138.50	0.48%	
	0.00	0.00	0.00%	0.00	0.00	0.00%	

CO	Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	Not Valid
	85.05	84.76	0.29%	85.05	84.43	0.62%	
	46.03	43.44	2.59%	46.03	NA	0.00%	
	25.00	23.98	1.02%	25.00	NA	0.00%	
	0.00	-0.05	0.05%	0.00	-0.59	0.59%	

SO2	Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
	149.10	149.40	0.17%	149.10	NA	0.00%	
	84.48	83.90	0.33%	84.48	84.00	0.27%	
	0.00	0.10	0.06%	0.00	0.50	0.29%	

HWAAP Monitor Calibration Data:

THC Span =	60.00 ppmv
NOx Span =	250.00 ppmv
CO Span =	100.00 ppmv
SO2 Span =	175.00 ppmv

Run # 2

THC

Calibration Gas Conc.	Precalibration Response	3.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
53.80	53.64	0.27%	53.80	55.31	2.52%	
24.88	25.37	0.82%	24.88	NA	0.00%	
8.05	7.73	0.53%	8.05	NA	0.00%	
0.00	0.01	0.02%	0.00	-0.34	0.57%	

NOx

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
225.80	225.20	0.24%	225.80	NA	0.00%	
137.30	138.50	0.48%	137.30	137.70	0.16%	
0.00	-0.10	0.04%	0.00	0.00	0.00%	

CO

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	Not Valid
85.05	85.70	0.65%	85.05	83.84	1.21%	
46.03	43.66	2.37%	46.03	NA	0.00%	
25.00	24.42	0.58%	25.00	NA	0.00%	
0.00	0.10	0.10%	0.00	2.15	2.15%	

SO2

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
149.10	149.40	0.17%	149.10	NA	0.00%	
84.48	84.00	0.27%	84.48	87.20	1.55%	
0.00	0.10	0.06%	0.00	1.30	0.74%	

HWAAP Monitor Calibration Data:

THC Span =	60.00 ppmv
NOx Span =	250.00 ppmv
CO Span =	100.00 ppmv
SO2 Span =	175.00 ppmv

Run # 3

THC

Calibration Gas Conc.	Precalibration Response	3.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	Not Valid THC down @ 1130 hr
53.80	53.52	0.47%	53.80	NA	0.00%	
24.88	24.87	0.02%	24.88	NA	0.00%	
8.05	7.63	0.70%	8.05	NA	0.00%	
0.00	-0.04	0.07%	0.00	NA	0.00%	

NOx

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
225.80	225.10	0.28%	225.80	NA	0.00%	
137.30	139.50	0.88%	137.30	139.60	0.92%	
0.00	-0.20	0.08%	0.00	2.00	0.80%	

CO

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	Not Valid
85.05	85.44	0.39%	85.05	NA	0.00%	
46.03	41.34	4.69%	46.03	NA	0.00%	
25.00	22.60	2.40%	25.00	NA	0.00%	
0.00	0.09	0.09%	0.00	NA	0.00%	

SO2

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
149.10	148.60	0.29%	149.10	NA	0.00%	
84.48	85.20	0.41%	84.48	80.80	2.10%	
0.00	-0.01	0.01%	0.00	0.00	0.00%	

HWAAP Monitor Calibration Data:

THC Span =	60.00 ppmv
NOx Span =	250.00 ppmv
CO Span =	100.00 ppmv
SO2 Span =	175.00 ppmv

Run # 4

THC

Calibration Gas Conc.	Precalibration Response	3.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	Not Valid Values drift ~ below zero.
53.80	53.88	0.13%	53.80	NA	0.00%	
24.88	25.13	0.42%	24.88	24.68	0.33%	
8.05	8.17	0.20%	8.05	NA	0.00%	
0.00	0.00	0.00%	0.00	-0.70	1.17%	

NOx

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	Not Valid
225.80	224.10	0.68%	225.80	NA	0.00%	
137.30	142.60	2.12%	137.30	148.70	4.56%	
0.00	0.00	0.00%	0.00	-0.10	0.04%	

CO

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
85.05	85.48	0.43%	85.05	NA	0.00%	
46.03	44.80	1.23%	46.03	43.36	2.67%	
25.00	25.76	0.76%	25.00	NA	0.00%	
0.00	0.16	0.16%	0.00	0.88	0.88%	

SO2

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
149.10	149.20	0.06%	149.10	NA	0.00%	
84.48	82.60	1.07%	84.48	80.40	2.33%	
0.00	0.10	0.06%	0.00	2.80	1.60%	

HWAAP Monitor Calibration Data:

THC Span =	60.00 ppmv
NOx Span =	250.00 ppmv
CO Span =	100.00 ppmv
SO2 Span =	175.00 ppmv

Run # 5

THC

Calibration Gas Conc.	Precalibration Response	3.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error
53.80	53.74	0.10%	53.80	NA	0.00%
24.88	24.57	0.52%	24.88	24.20	1.13%
8.05	8.00	0.08%	8.05	NA	0.00%
0.00	0.00	0.00%	0.00	0.00	0.00%

VALID

NOx

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error
225.80	225.20	0.24%	225.80	NA	0.00%
137.30	138.50	0.48%	137.30	139.50	0.88%
0.00	0.04	0.02%	0.00	0.30	0.12%

VALID

CO

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error
85.05	85.92	0.87%	85.05	NA	0.00%
46.03	43.82	2.21%	46.03	38.80	7.23%
25.00	23.66	1.34%	25.00	NA	0.00%
0.00	0.05	0.05%	0.00	-2.20	2.20%

Not Valid

SO2

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error
149.10	149.40	0.17%	149.10	NA	0.00%
84.48	81.60	1.65%	84.48	33.10	29.36%
0.00	0.01	0.01%	0.00	1.60	0.91%

Not Valid

HWAAP Monitor Calibration Data:

THC Span =	60.00 ppmv
NOx Span =	250.00 ppmv
CO Span =	100.00 ppmv
SO2 Span =	175.00 ppmv

Run # 6

THC

Calibration Gas Conc.	Precalibration Response	3.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
53.80	53.81	0.02%	53.80	NA	0.00%	
24.88	25.61	1.22%	24.88	25.17	0.48%	
8.05	8.73	1.13%	8.05	NA	0.00%	
0.00	0.01	0.02%	0.00	0.01	0.02%	

NOx

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
225.80	225.00	0.32%	225.80	227.10	0.52%	
137.30	NA	NA	137.30	NA	0.00%	
0.00	-0.20	0.08%	0.00	-0.10	0.04%	

CO

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
85.05	85.60	0.55%	85.05	NA	0.00%	
46.03	44.22	1.81%	46.03	46.00	0.03%	
25.00	25.46	0.46%	25.00	NA	0.00%	
0.00	0.22	0.22%	0.00	1.18	1.18%	

SO2

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
149.10	150.00	0.51%	149.10	NA	0.00%	
84.48	82.40	1.19%	84.48	82.80	0.96%	
0.00	0.10	0.06%	0.00	1.50	0.86%	

HWAAP Monitor Calibration Data:

THC Span =	60.00	ppmv
NOx Span =	250.00	ppmv
CO Span =	100.00	ppmv
SO2 Span =	175.00	ppmv

Run # 7

THC

Calibration Gas Conc.	Precalibration Response	3.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
53.80	53.44	0.60%	53.80	NA	0.00%	
24.88	24.58	0.50%	24.88	24.50	0.63%	
8.05	8.45	0.67%	8.05	NA	0.00%	
0.00	0.02	0.03%	0.00	-0.02	0.03%	

NOx

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	Not Valid
225.80	225.30	0.20%	225.80	224.10	0.68%	
137.30	NA	54.92%	137.30	NA	0.00%	
0.00	-0.01	0.00%	0.00	-1.10	0.44%	

CO

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	VALID
85.05	85.26	0.21%	85.05	NA	0.00%	
46.03	44.10	1.93%	46.03	43.44	2.59%	
25.00	23.68	1.32%	25.00	NA	0.00%	
0.00	0.29	0.29%	0.00	0.13	0.13%	

SO2

Calibration Gas Conc.	Precalibration Response	2.00% % Error	Calibration Gas Conc.	Post Calibration Response	3.00% % Error	Not Valid Moisture in gas line.
149.10	149.40	0.17%	149.10	NA	0.00%	
84.48	85.40	0.53%	84.48	NA	0.00%	
0.00	0.10	0.06%	0.00	NA	0.00%	

SO2 System Bias Check 20 October 1994

	Source	Value (ppmv)	Value (ppmv)	
pre	line	83.900	0.100	
pre	direct	84.800	0.000	
post	line	84.000	0.500	
post	direct	84.900	0.300	
Actual Gas		84.900	0.000	ppmv

NOx System Bias Check 20 October 1994

	Source	Value (ppmv)	Value (ppmv)	
pre	line	138.5	0.00	
pre	direct	138.9	0.00	
post	line	138.5	-0.10	
post	direct	139.0	0.00	
Actual Gas		137.30	0.00	ppmv

APPENDIX N

THC CONTINUOUS EMISSION MONITOR DATA SUMMARY

TABLE N-1. SUMMARY OF HGD SYSTEM THC EMISSION DURING EACH METALS TEST

DATE		RUN 2 10/21/94	RUN 4 10/24/94	RUN 6 10/27/94
FEED DATA				
Average Batch Feed				
175mm COMP B Proj	(No.)	480	480	480
	(lb/ea)	115	115	115
	(tons)*	27.6	27.6	27.6
STACK GAS DATA				
CO_2 Concentration (%, dry)		8.0	7.2	7.8
O_2 Concentration (%, dry)		10.8	12.0	11.2
CO Concentration (%, dry)		0.0	0.0	0.0
N_2 Concentration (%, dry)		81.2	80.8	81.0
Stack Gas Moisture Content	(%)	7.31	5.13	7.45
Stack Gas Molecular Weight (lb/lb-mole, wet)		28.86	29.04	28.82
Volumetric Flow Rate (dscf/hr)		233766	202153	215519
SAMPLING EQUIPMENT DATA				
Dry Gas Volume (dscf)		32.90	33.81	37.66
Total Sampling Time (min)		60	72	72
Isokinetic Sampling Rate (%)		104.53	103.51	105.49
EMISSION DATA				
Avg CEM Conc. Reading as Propane (ppmv)		0.065	†	0.265
Avg Corrected C_{THC} Conc as Carbon (ppmv)		0.195	†	0.794
Density C_3H_8 (lb/ft^3)		0.116	0.116	0.116
Avg THC Emission Rate	(lb/hr)	0.002	†	0.009
	(tons/yr)	0.008	†	0.040

* Batch feed rate exceeds previous limit of 25 tons.
† Monitor not within calibration requirements.

TABLE N-2. SUMMARY OF HGD SYSTEM THC EMISSIONS DURING EACH PM_{10} TEST

		RUN 1*	RUN 3	RUN 5	RUN 7
DATE		10/20/94	10/23/94	10/26/94	10/29/94
FEED DATA					
Average Batch Feed					
175mm COMP B Proj	(No.)	480	480	480	480
	(lb/ea)	115	115	115	115
	(tons)†	27.6	27.6	27.6	27.6
STACK GAS DATA					
CO_2 Concentration (%, dry)		7.8	7.8	7.6	8.0
O_2 Concentration (%, dry)		11.0	10.6	11.4	10.8
CO Concentration (%, dry)		0.0	0.0	0.0	0.0
N_2 Concentration (%, dry)		81.2	81.6	81.0	81.2
Stack Gas Moisture Content (%)		*	6.12	7.76	7.53
Stack Gas Molecular Weight (lb/lb-mole, wet)		*	28.96	28.77	28.83
Volumetric Flow Rate (dscf/hr)		226611‡	224552	237201	246473
SAMPLING EQUIPMENT DATA					
Dry Gas Volume (dscf)		*	62.722	64.295	70.139
Total Sampling Time (min)		*	120	120	120
Isokinetic Sampling Rate (%)		*	103.75	100.68	103.09
EMISSION DATA					
Avg CEM Conc. Reading as Propane (ppmv)		0.014	♦	0.396	0.142
Avg Corrected C_{THC} Conc as Carbon (ppmv)		0.043	♦	1.187	0.426
Density C_3H_8 (lb/ft^3)		0.116	0.116	0.116	0.116
Avg THC Emission Rate	(lb/hr)	0.001	♦	0.011	0.004
	(tons/yr)	0.002	♦	0.048	0.018

* PM_{10} train failed intermediate leak check.
† Batch feed rate exceeds previous limit of 25 tons.
‡ Run 1 stack gas flow rate is an average of run 2 through 7.
♦ Monitor not within calibration requirements.

APPENDIX O

NO_x CONTINUOUS EMISSION MONITOR DATA SUMMARY

TABLE O-1. SUMMARY OF HGD SYSTEM NO_x EMISSION DURING EACH METALS TEST

DATE		RUN 2 10/21/94	RUN 4 10/24/94	RUN 6 10/27/94
FEED DATA				
Average Batch Feed				
175mm COMP B Proj	(No.)	480	480	480
	(lb/ea)	115	115	115
	(tons)*	27.6	27.6	27.6
STACK GAS DATA				
CO_2 Concentration (%, dry)		8.0	7.2	7.8
O_2 Concentration (%, dry)		10.8	12.0	11.2
CO Concentration (%, dry)		0.0	0.0	0.0
N_2 Concentration (%, dry)		81.2	80.8	81.0
Stack Gas Moisture Content	(%)	7.31	5.13	7.45
Stack Gas Molecular Weight (lb/lb-mole, wet)		28.86	29.04	28.82
Volumetric Flow Rate (dscf/hr)		233766	202153	215519
SAMPLING EQUIPMENT DATA				
Dry Gas Volume (dscf)		32.90	33.81	37.66
Total Sampling Time (min)		60	72	72
Isokinetic Sampling Rate (%)		104.53	103.51	105.49
CEM CALIBRATION DATA				
C_0 (ppmv)		-0.05	†	†
C_m (ppmv)		138.10	†	†
C_{ma} (ppmv)		137.30	†	†
EMISSION DATA				
Avg CEM Conc. Reading (ppmv)		70.0	†	†
Avg Corrected Conc (ppmv)		69.6	†	†
Density NO_2 (lb/ft^3)		0.120	0.120	0.120
Avg NO_x Emission Rate	(lb/hr)	1.96	†	†
	(tons/yr)	8.58	†	†

* Batch feed rate exceeds previous limit of 25 tons.
† Monitor not within calibration requirements.

TABLE O-2. SUMMARY OF HGD SYSTEM NO_x EMISSIONS DURING EACH PM_{10} TEST

DATE	RUN 1* 10/20/94	RUN 3 10/23/94	RUN 5 10/26/94	RUN 7 10/29/94
FEED DATA				
Average Batch Feed				
175mm COMP B Proj (No.)	480	480	480	480
(lb/ea)	115	115	115	115
(tons)†	27.6	27.6	27.6	27.6
STACK GAS DATA				
CO_2 Concentration (%, dry)	7.8	7.8	7.6	8.0
O_2 Concentration (%, dry)	11.0	10.6	11.4	10.8
CO Concentration (%, dry)	0.0	0.0	0.0	0.0
N_2 Concentration (%, dry)	81.2	81.6	81.0	81.2
Stack Gas Moisture Content (%)	*	6.12	7.76	7.53
Stack Gas Molecular Weight (lb/lb-mole, wet)	*	28.96	28.77	28.83
Volumetric Flow Rate (dscf/hr)	226611‡	224552	237201	246473
SAMPLING EQUIPMENT DATA				
Dry Gas Volume (dscf)	*	62.722	64.295	70.139
Total Sampling Time (min)	*	120	120	120
Isokinetic Sampling Rate (%)	*	103.75	100.68	103.09
CEM CALIBRATION DATA				
C_0 (ppmv)	0.00	0.90	0.17	♦
C_m (ppmv)	138.50	139.55	139.00	♦
C_{ma} (ppmv)	137.30	137.30	137.30	♦
EMISSION DATA				
Avg CEM Conc. Reading (ppmv)	134.4	160.6	159.0	♦
Avg Corrected C_{gas} Conc (ppmv)	133.3	158.2	175.9	♦
Density NO_2 (lb/ft^3)	0.120	0.120	0.120	0.120
Avg NO_x Emission Rate (lb/hr)	3.63	4.27	5.03	♦
(tons/yr)	15.91	18.72	22.04	♦

* PM_{10} train failed intermediate leak check.
† Batch feed rate exceeds previous limit of 25 tons.
‡ Run 1 stack gas flow rate is an average of run 2 through 7.
♦ Monitor not within calibration requirements.

SAMPLE CALCULATION RUN 1.

$$C_{gas} = (134.4 - 0.00) * \frac{137.30}{(138.5 - 0.0)}$$

$$= 133.3 \text{ ppmv}$$

$$W_{NO_x} = \frac{133.3 * 0.120 * 226611}{10\text{^}6}$$

$$= 3.63 \text{ lb/hr}$$

APPENDIX P

CO CONTINUOUS EMISSION MONITOR DATA SUMMARY

TABLE P-1. SUMMARY OF HGD SYSTEM CO EMISSION DURING EACH METALS TEST

DATE		RUN 2 10/21/94	RUN 4 10/24/94	RUN 6 10/27/94
FEED DATA				
Average Batch Feed				
175mm COMP B Proj	(No.)	480	480	480
	(lb/ea)	115	115	115
	(tons)*	27.6	27.6	27.6
STACK GAS DATA				
CO_2 Concentration (%, dry)		8.0	7.2	7.8
O_2 Concentration (%, dry)		10.8	12.0	11.2
CO Concentration (%, dry)		0.0	0.0	0.0
N_2 Concentration (%, dry)		81.2	80.8	81.0
Stack Gas Moisture Content	(%)	7.31	5.13	7.45
Stack Gas Molecular Weight (lb/lb-mole, wet)		28.86	29.04	28.82
Volumetric Flow Rate (dscf/hr)		233766	202153	215519
SAMPLING EQUIPMENT DATA				
Dry Gas Volume (dscf)		32.90	33.81	37.66
Total Sampling Time (min)		60	72	72
Isokinetic Sampling Rate (%)		104.53	103.51	105.49
EMISSION DATA				
Avg CEM Conc. Reading (ppmv)		†	9.1	9.9
Avg Corrected C_{CO} Conc (ppmv)		†	8.4	9.2
Density CO (lb/ft^3)		0.073	0.073	0.073
Avg CO Emission Rate	(lb/hr)	†	0.12	0.14
	(tons/yr)	†	0.54	0.63

* Batch feed rate exceeds previous limit of 25 tons.
† Monitor not within calibration requirements.

TABLE P-2. SUMMARY OF HGD SYSTEM CO EMISSIONS DURING EACH PM_{10} TEST

DATE		RUN 1* 10/20/94	RUN 3 10/23/94	RUN 5 10/26/94	RUN 7 10/29/94
FEED DATA					
Average Batch Feed					
175mm COMP B Proj	(No.)	480	480	480	480
	(lb/ea)	115	115	115	115
	(tons)†	27.6	27.6	27.6	27.6
STACK GAS DATA					
CO_2 Concentration (%, dry)		7.8	7.8	7.6	8.0
O_2 Concentration (%, dry)		11.0	10.6	11.4	10.8
CO Concentration (%, dry)		0.0	0.0	0.0	0.0
N_2 Concentration (%, dry)		81.2	81.6	81.0	81.2
Stack Gas Moisture Content (%)		*	6.12	7.76	7.53
Stack Gas Molecular Weight (lb/lb-mole, wet)		*	28.96	28.77	28.83
Volumetric Flow Rate (dscf/hr)		226611‡	224552	237201	246473
SAMPLING EQUIPMENT DATA					
Dry Gas Volume (dscf)		*	62.722	64.295	70.139
Total Sampling Time (min)		*	120	120	120
Isokinetic Sampling Rate (%)		*	103.75	100.68	103.09
EMISSION DATA					
Avg CEM Conc. Reading (ppmv)		♦	♦	♦	10.5
Avg Corrected C_{CO} Conc (ppmv)		♦	♦	♦	9.6
Density CO (lb/ft^3)		0.073	0.073	0.073	0.073
Avg CO Emission Rate	(lb/hr)	♦	♦	♦	0.17
	(tons/yr)	♦	♦	♦	0.76

* PM_{10} train failed intermediate leak check.
† Batch feed rate exceeds previous limit of 25 tons.
‡ Run 1 stack gas flow rate is an average of run 2 through 7.
♦ Monitor not within calibration requirements.

SAMPLE CALCULATION RUN 4.

$$C_{CO} = 9.1 * (1 - 0.072)$$

$$= 8.4 \text{ ppmv}$$

$$W_{CO} = \frac{8.4 * 0.073 * 202153}{10\text{^}6}$$

$$= 0.12 \text{ lb/hr}$$

APPENDIX Q

SO_2 CONTINUOUS EMISSION MONITOR DATA SUMMARY

ABLE Q-1. SUMMARY OF HGD SYSTEM SO_2 EMISSION DURING EACH METALS TEST

ATE		RUN 2 10/21/94	RUN 4 10/24/94	RUN 6 10/27/94
EED DATA				
verage Batch Feed				
175mm COMP B Proj	(No.)	480	480	480
	(lb/ea)	115	115	115
	(tons)*	27.6	27.6	27.6
TACK GAS DATA				
O_2 Concentration (%, dry)		8.0	7.2	7.8
$_2$ Concentration (%, dry)		10.8	12.0	11.2
O Concentration (%, dry)		0.0	0.0	0.0
$_2$ Concentration (%, dry)		81.2	80.8	81.0
tack Gas Moisture Content	(%)	7.31	5.13	7.45
tack Gas Molecular Weight				
(lb/lb-mole, wet)		28.86	29.04	28.82
olumetric Flow				
Rate (dscf/hr)		233766	202153	215519
AMPLING EQUIPMENT DATA				
ry Gas Volume (dscf)		32.90	33.81	37.66
otal Sampling Time (min)		60	72	72
sokinetic Sampling Rate (%)		104.53	103.51	105.49
EM CALIBRATION DATA				
$_0$ (ppmv)		0.70	1.45	0.80
$_m$ (ppmv)		85.60	81.50	82.60
$_{ma}$ (ppmv)		84.48	84.48	84.48
EMISSION DATA				
Avg CEM Conc.				
Reading (ppmv)		65.3	68.4	48.4
Avg Corrected				
Conc (ppmv)		64.2	70.7	49.1
Density SO_2 (lb/ft^3)		0.168	0.168	0.168
Avg SO_2 Emission				
Rate (lb/hr)		2.52	2.40	1.78
(tons/yr)		11.05	10.52	7.79

* Batch feed rate exceeds previous limit of 25 tons.

TABLE Q-2. SUMMARY OF HGD SYSTEM SO_2 EMISSIONS DURING EACH PM_{10} TEST

DATE	RUN 1* 10/20/94	RUN 3 10/23/94	RUN 5 10/26/94	RUN 7 10/29/94
FEED DATA				
Average Batch Feed				
175mm COMP B Proj (No.)	480	480	480	480
(lb/ea)	115	115	115	115
(tons)†	27.6	27.6	27.6	27.6
STACK GAS DATA				
CO_2 Concentration (%, dry)	7.8	7.8	7.6	8.0
O_2 Concentration (%, dry)	11.0	10.6	11.4	10.8
CO Concentration (%, dry)	0.0	0.0	0.0	0.0
N_2 Concentration (%, dry)	81.2	81.6	81.0	81.2
Stack Gas Moisture Content (%)	*	6.12	7.76	7.53
Stack Gas Molecular Weight (lb/lb-mole, wet)	*	28.96	28.77	28.83
Volumetric Flow Rate (dscf/hr)	226611‡	224552	237201	246473
SAMPLING EQUIPMENT DATA				
Dry Gas Volume (dscf)	*	62.722	64.295	70.139
Total Sampling Time (min)	*	120	120	120
Isokinetic Sampling Rate (%)	*	103.75	100.68	103.09
CEM CALIBRATION DATA				
C_0 (ppmv)	0.30	0.00	♦	♦
C_m (ppmv)	83.95	83.00	♦	♦
C_{ma} (ppmv)	84.48	84.48	♦	♦
EMISSION DATA				
Avg CEM Conc. Reading (ppmv)	70.6	65.3	♦	♦
Avg Corrected C_{gas} Conc (ppmv)	71.0	64.2	♦	♦
Density SO_2 (lb/ft^3)	0.168	0.168	0.168	0.168
Avg SO_2 Emission Rate (lb/hr)	2.70	2.72	♦	♦
(tons/yr)	11.84	11.92	♦	♦

* PM_{10} train failed intermediate leak check.
† Batch feed rate exceeds previous limit of 25 tons.
‡ Run 1 stack gas flow rate is an average of run 2 through 7.
♦ Monitor not within calibration requirements.

SAMPLE CALCULATION RUN 1.

$$C_{gas} = (70.6 - 0.30) * \frac{84.48}{(83.95 - 0.30)}$$

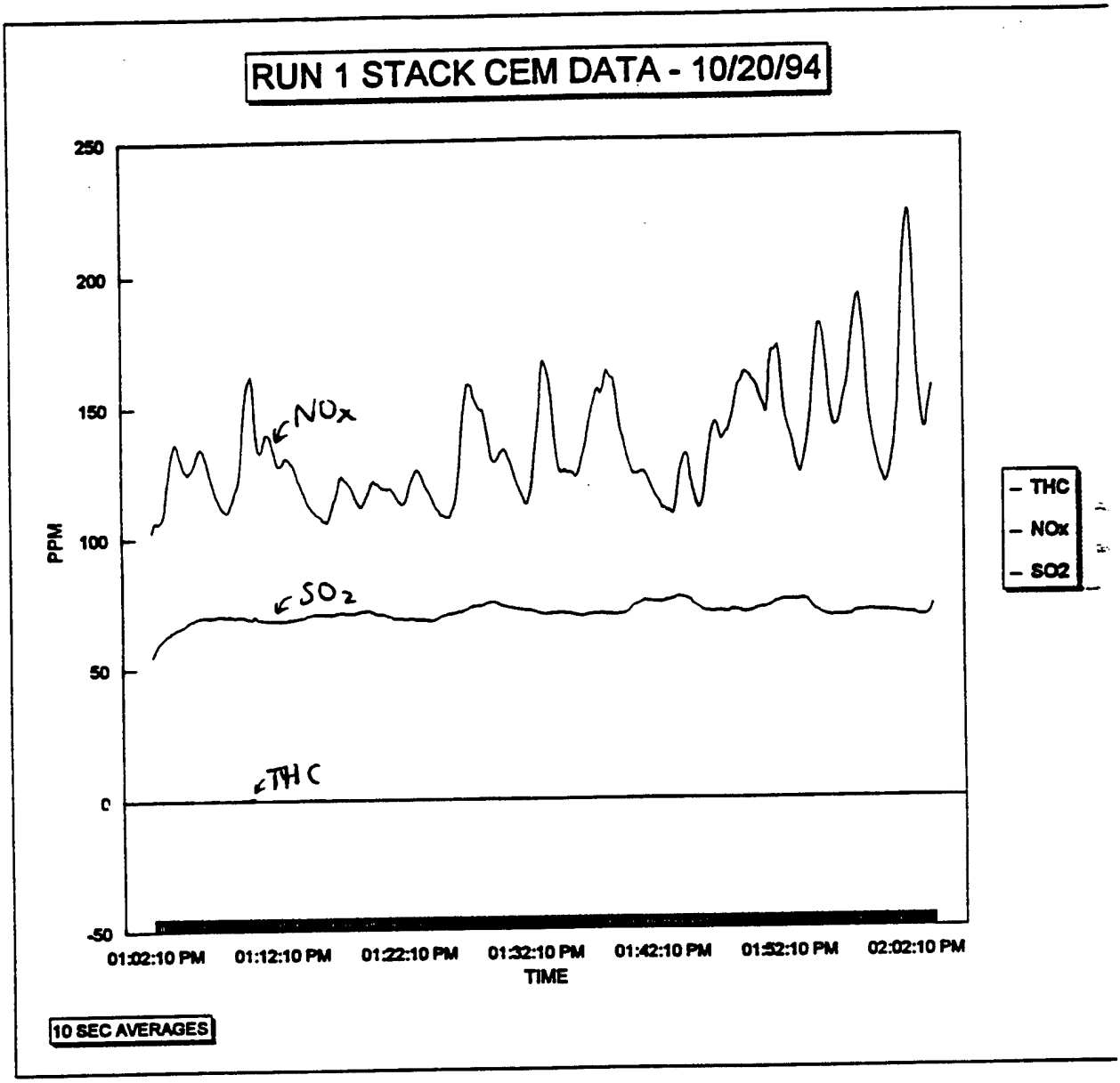
$$= 71.0 \text{ ppmv}$$

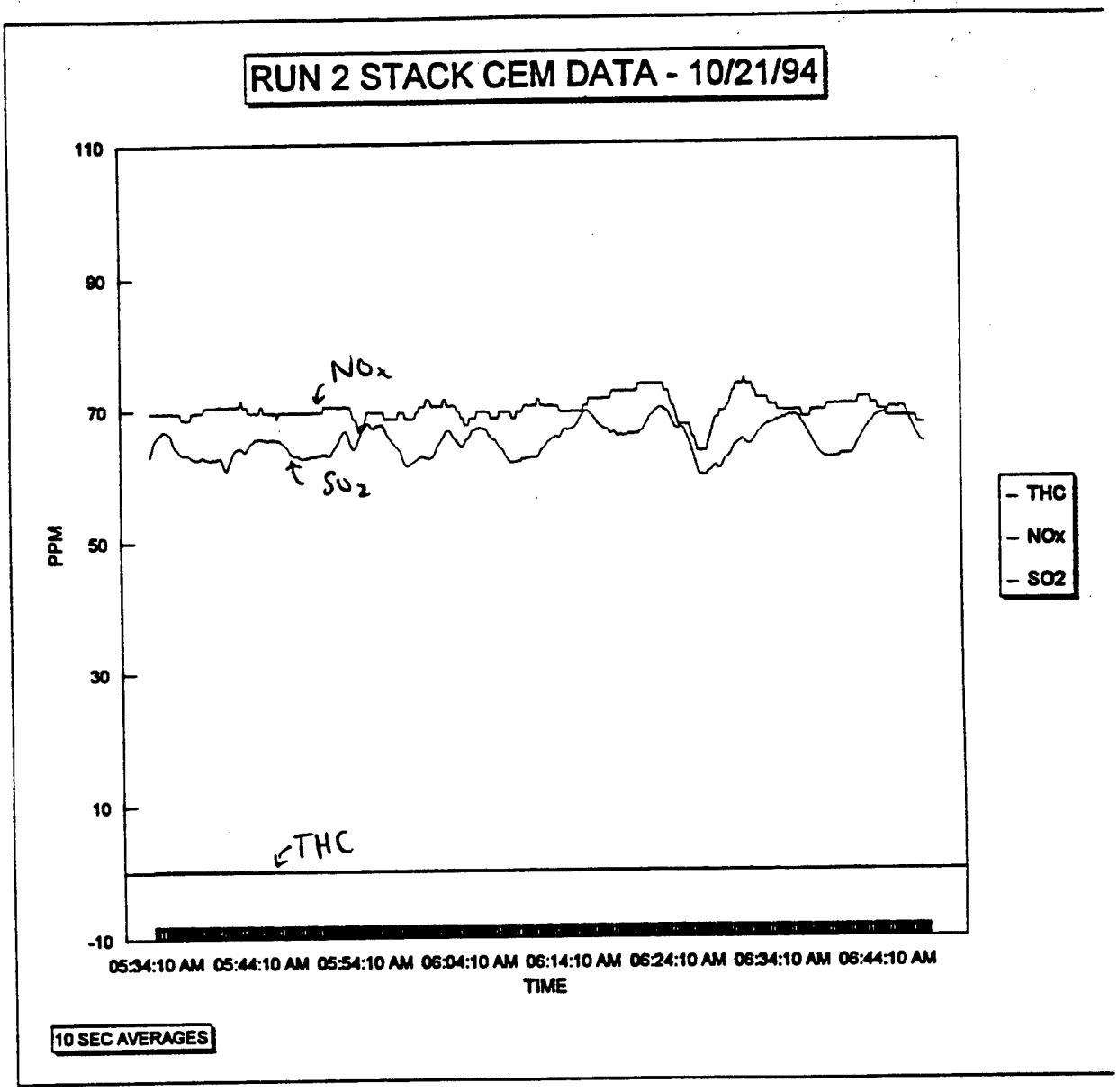
$$W_{SO_2} = \frac{71.0 * 0.168 * 226611}{10\text{^}6}$$

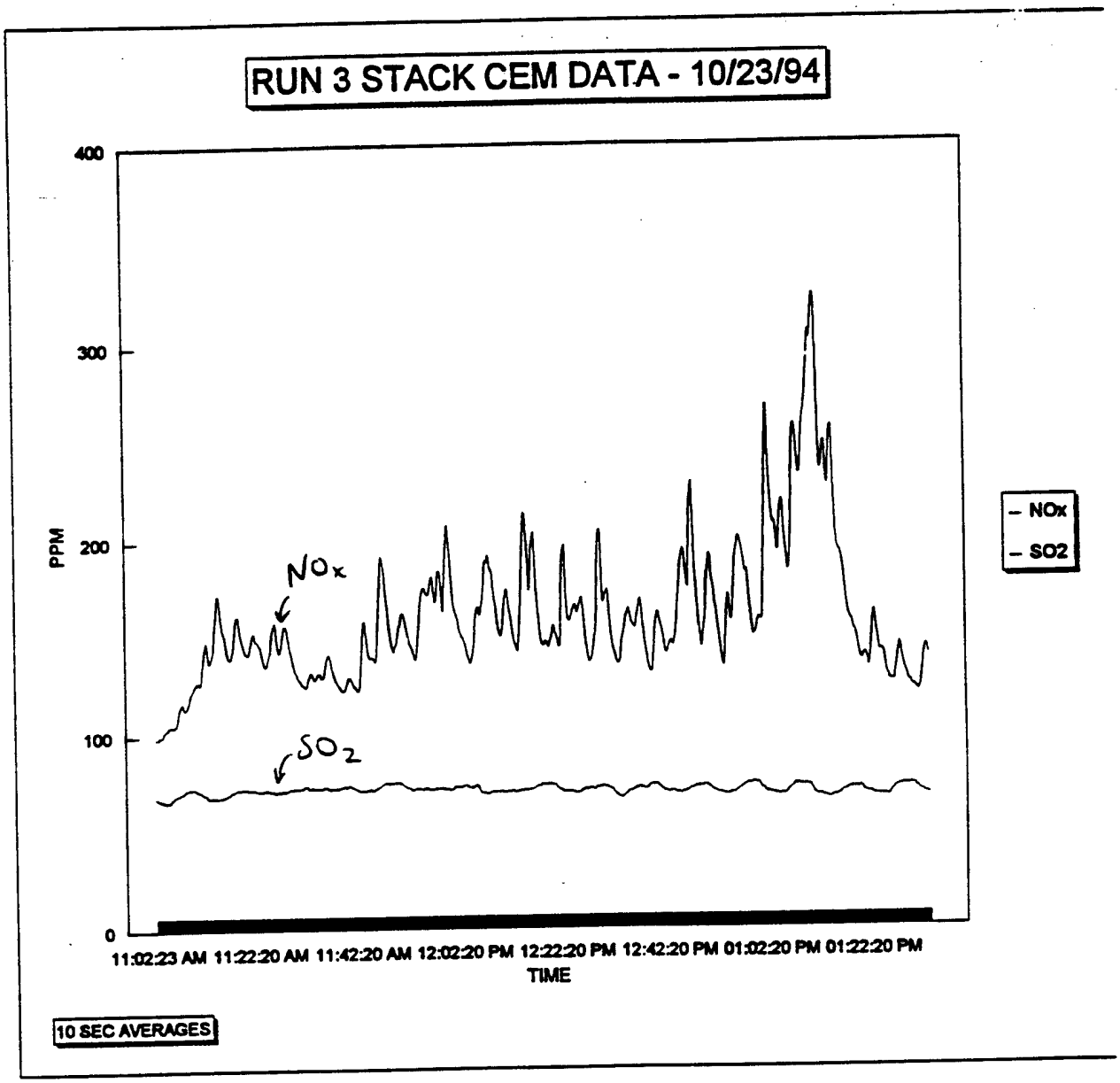
$$= 2.70 \text{ lb/hr}$$

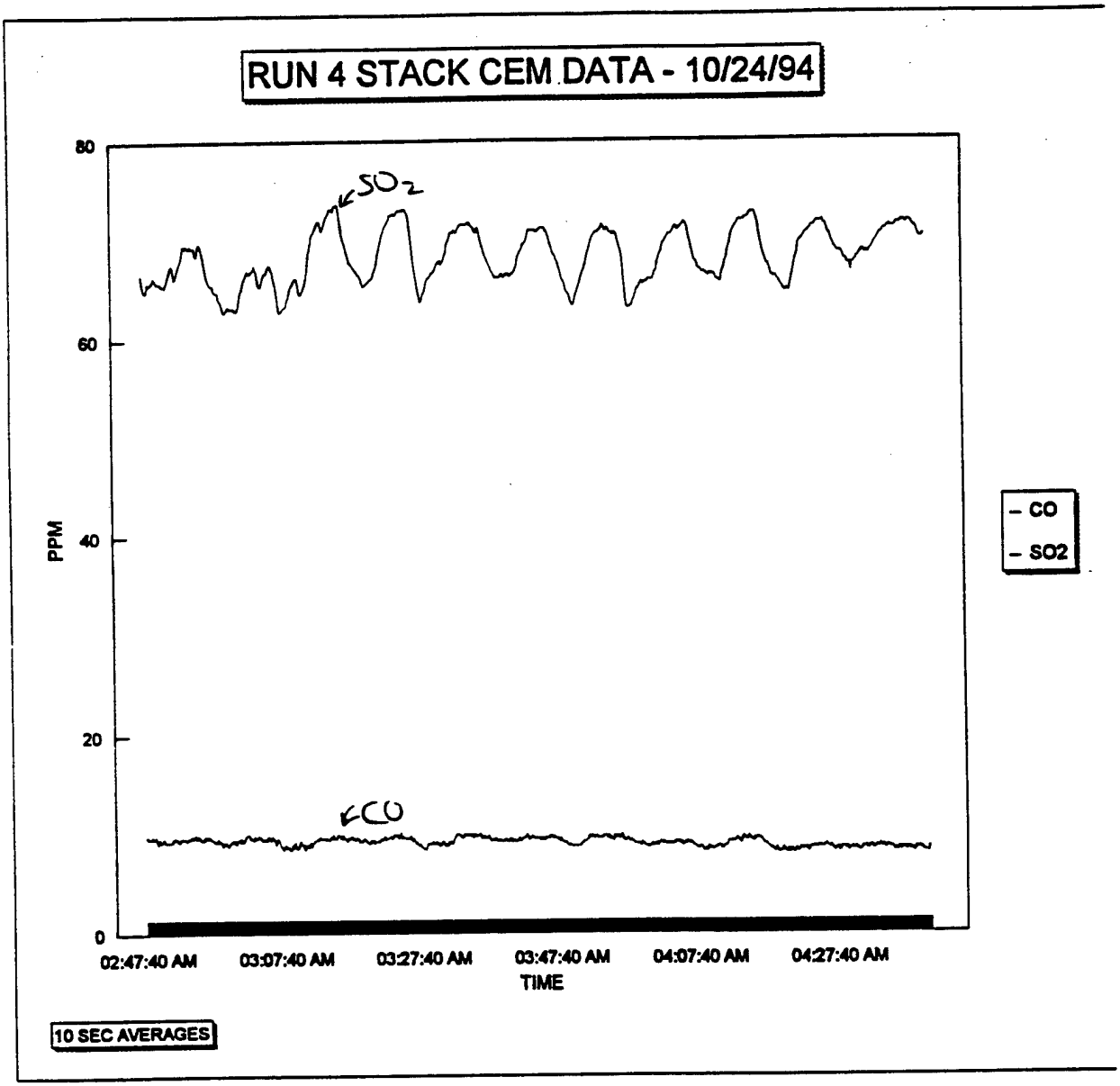
APPENDIX R

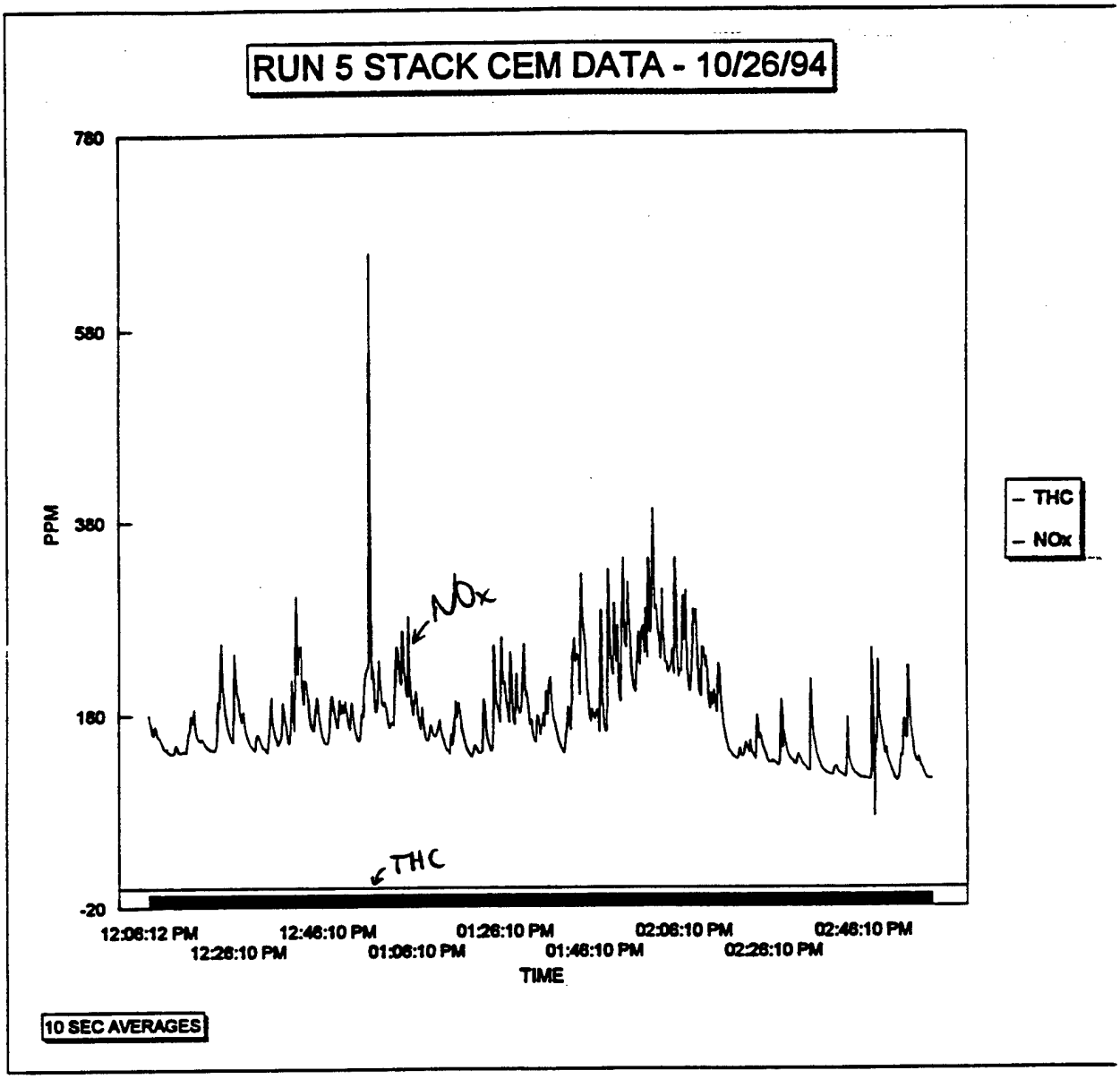
STACK CONTINUOUS EMISSION MONITOR GRAPHS AND DATA SUMMARY

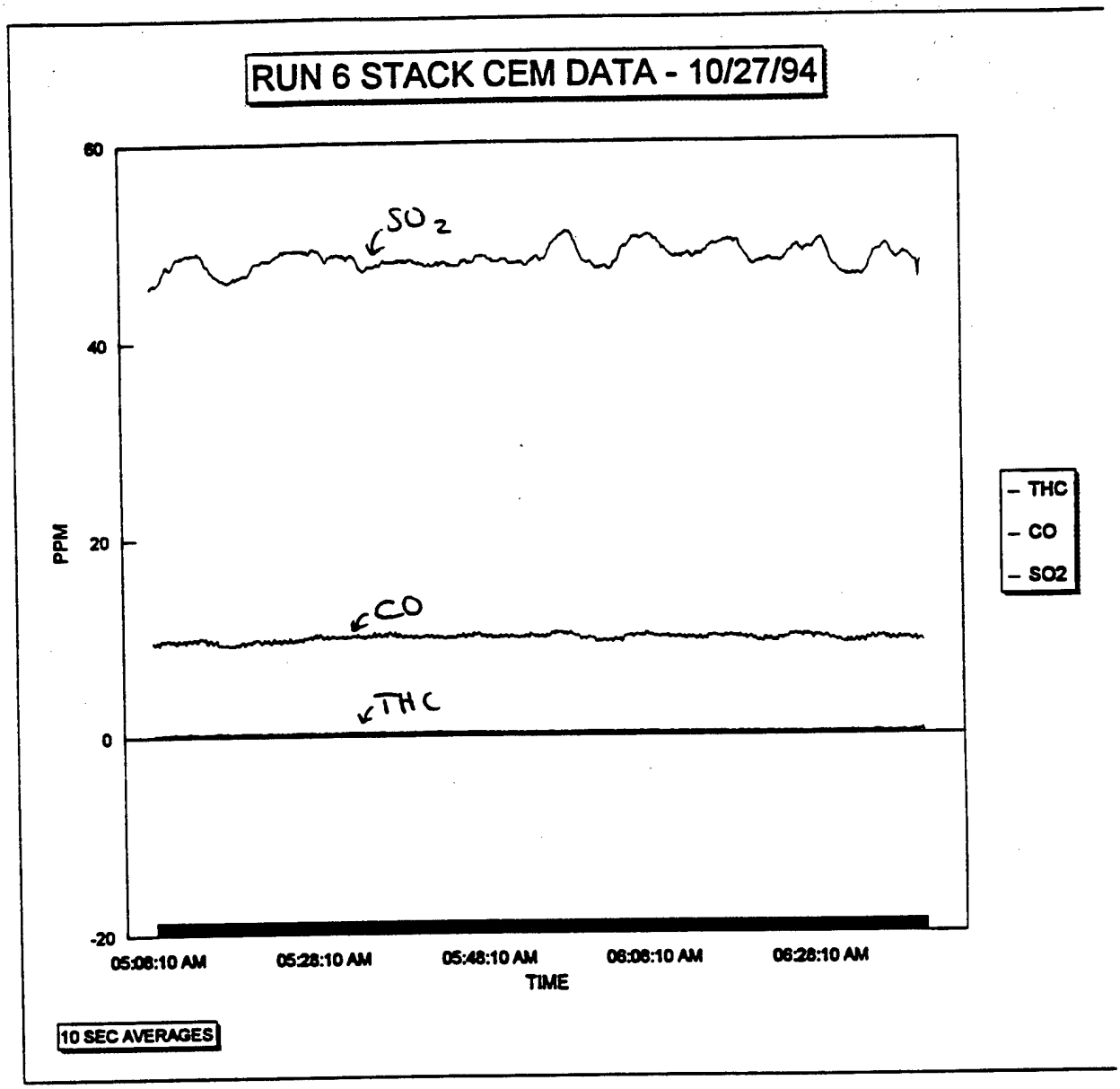

RUN 1 STACK CEM DATA - 10/20/94
250
200
150
100
50
0
-50
PPM
NOx
SO2
THC
01:02:10 PM
01:12:10 PM
01:22:10 PM
01:32:10 PM
01:42:10 PM
01:52:10 PM
02:02:10 PM
TIME
THC
NOx
SO2
10 SEC AVERAGES

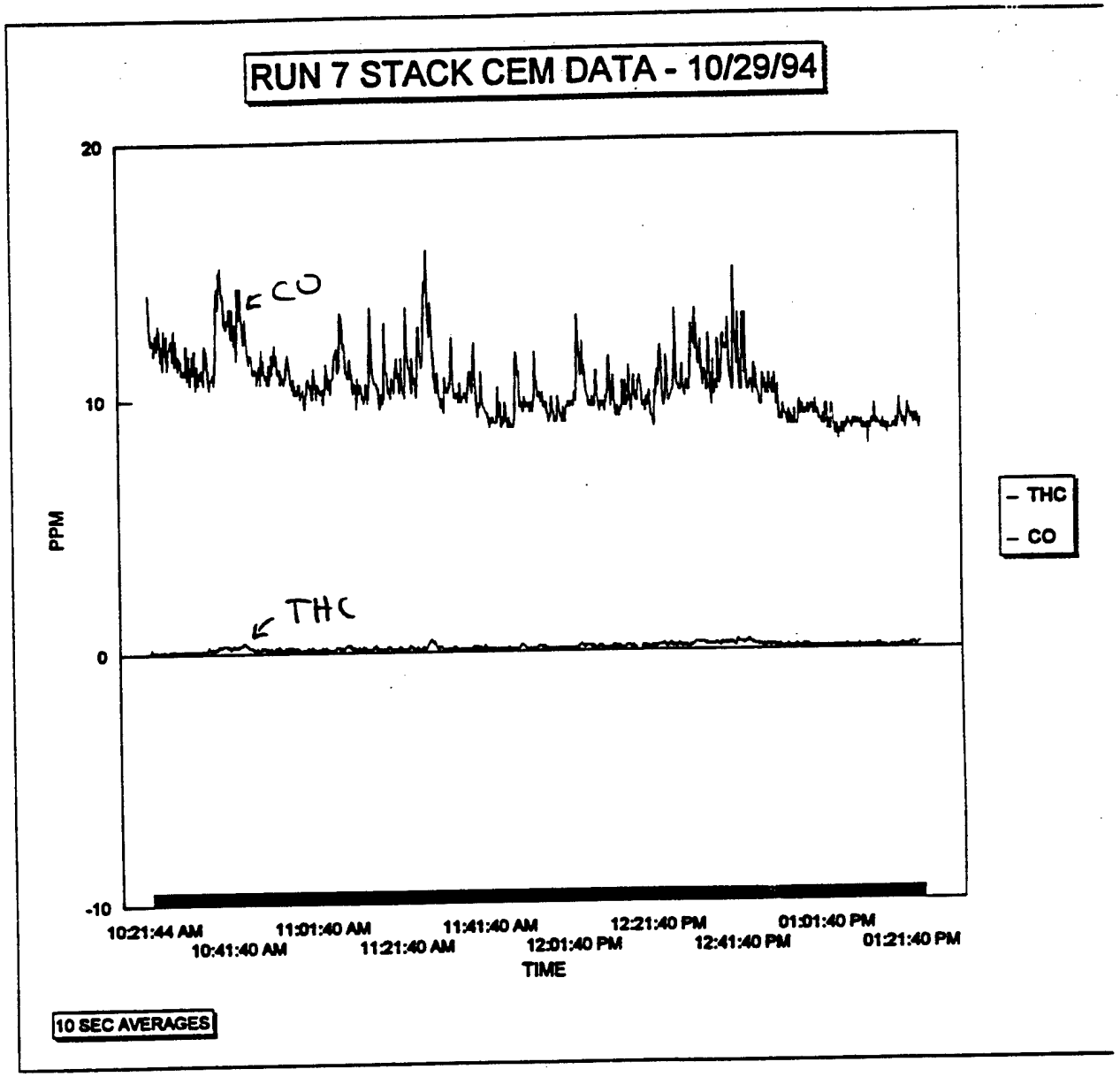

RUN 2 STACK CEM DATA - 10/21/94
110
90
70
50
30
10
-10
PPM
NOx
SO2
THC
05:34:10 AM
05:44:10 AM
05:54:10 AM
06:04:10 AM
06:14:10 AM
06:24:10 AM
06:34:10 AM
06:44:10 AM
TIME
THC
NOx
SO2
10 SEC AVERAGES


RUN 3 STACK CEM DATA - 10/23/94
400
300
200
100
0
PPM
NOx
SO2
11:02:23 AM 11:22:20 AM 11:42:20 AM 12:02:20 PM 12:22:20 PM 12:42:20 PM 01:02:20 PM 01:22:20 PM
TIME
NOx
SO2
10 SEC AVERAGES


RUN 4 STACK CEM DATA - 10/24/94
80
60
40
20
0
PPM
SO2
CO
02:47:40 AM
03:07:40 AM
03:27:40 AM
03:47:40 AM
04:07:40 AM
04:27:40 AM
TIME
– CO
– SO2
10 SEC AVERAGES


RUN 5 STACK CEM DATA - 10/26/94
780
580
380
180
-20
PPM
NOx
THC
12:06:12 PM
12:26:10 PM
12:46:10 PM
01:06:10 PM
01:26:10 PM
01:46:10 PM
02:06:10 PM
02:26:10 PM
02:46:10 PM
TIME
THC
NOx
10 SEC AVERAGES


RUN 6 STACK CEM DATA - 10/27/94
60
40
20
0
-20
PPM
SO2
CO
THC
05:08:10 AM
05:28:10 AM
05:48:10 AM
06:08:10 AM
06:28:10 AM
TIME
– THC
– CO
– SO2
10 SEC AVERAGES


RUN 7 STACK CEM DATA - 10/29/94
20
10
0
-10
PPM
CO
THC
10:21:44 AM
10:41:40 AM
11:01:40 AM
11:21:40 AM
11:41:40 AM
12:01:40 PM
12:21:40 PM
12:41:40 PM
01:01:40 PM
01:21:40 PM
TIME
– THC
– CO
10 SEC AVERAGES

Run 1

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
20-Oct-94	01:02 PM	0.06	105.44	7.40	57.92
20-Oct-94	01:03 PM	0.00	120.98	7.07	62.97
20-Oct-94	01:04 PM	-0.03	130.97	7.20	65.87
20-Oct-94	01:05 PM	-0.02	128.48	7.33	68.63
20-Oct-94	01:06 PM	0.02	129.15	6.90	69.63
20-Oct-94	01:07 PM	-0.02	114.12	6.90	69.90
20-Oct-94	01:08 PM	0.05	114.15	7.47	69.73
20-Oct-94	01:09 PM	0.47	144.32	6.97	69.87
20-Oct-94	01:10 PM	0.17	143.72	7.17	69.00
20-Oct-94	01:11 PM	-0.02	137.08	6.97	68.07
20-Oct-94	01:12 PM	0.00	128.93	6.87	68.03
20-Oct-94	01:13 PM	-0.02	125.83	6.63	68.83
20-Oct-94	01:14 PM	0.10	114.10	6.50	69.93
20-Oct-94	01:15 PM	0.07	107.98	6.63	70.63
20-Oct-94	01:16 PM	0.02	112.00	7.03	70.73
20-Oct-94	01:17 PM	-0.05	121.80	6.80	71.07
20-Oct-94	01:18 PM	-0.10	114.00	7.27	71.33
20-Oct-94	01:19 PM	-0.10	118.82	6.97	71.43
20-Oct-94	01:20 PM	-0.05	119.07	6.77	70.13
20-Oct-94	01:21 PM	-0.10	115.63	6.83	68.90
20-Oct-94	01:22 PM	-0.08	117.98	7.07	68.60
20-Oct-94	01:23 PM	-0.10	122.93	6.50	68.33
20-Oct-94	01:24 PM	-0.10	113.15	6.80	68.30
20-Oct-94	01:25 PM	-0.08	108.30	7.23	70.13
20-Oct-94	01:26 PM	-0.10	126.92	7.83	71.30
20-Oct-94	01:27 PM	-0.03	155.70	7.43	72.93
20-Oct-94	01:28 PM	0.10	144.75	7.30	74.17
20-Oct-94	01:29 PM	0.10	130.27	7.17	74.37
20-Oct-94	01:30 PM	0.08	128.93	6.97	72.80
20-Oct-94	01:31 PM	0.08	115.97	7.30	71.97
20-Oct-94	01:32 PM	0.00	131.38	7.27	71.17
20-Oct-94	01:33 PM	-0.02	161.67	6.60	70.27
20-Oct-94	01:34 PM	-0.05	128.42	6.57	70.77
20-Oct-94	01:35 PM	0.00	123.93	6.40	70.03
20-Oct-94	01:36 PM	0.00	135.73	6.70	69.73
20-Oct-94	01:37 PM	0.00	154.20	6.73	70.23
20-Oct-94	01:38 PM	0.00	160.53	6.33	69.93
20-Oct-94	01:39 PM	0.03	136.25	6.07	70.63
20-Oct-94	01:40 PM	0.08	124.27	6.50	73.87
20-Oct-94	01:41 PM	0.10	120.45	6.50	74.93
20-Oct-94	01:42 PM	0.10	111.75	6.70	74.77
20-Oct-94	01:43 PM	0.08	113.95	7.20	76.13
20-Oct-94	01:44 PM	0.03	126.77	6.50	75.53
20-Oct-94	01:45 PM	0.03	114.08	7.00	72.17
20-Oct-94	01:46 PM	-0.03	137.90	6.80	70.97
20-Oct-94	01:47 PM	0.00	139.10	7.07	71.00
20-Oct-94	01:48 PM	0.00	154.40	7.13	71.23
20-Oct-94	01:49 PM	0.02	160.87	6.93	70.97
20-Oct-94	01:50 PM	0.00	151.53	7.33	72.30
20-Oct-94	01:51 PM	0.00	169.25	7.27	74.13
20-Oct-94	01:52 PM	0.00	141.75	6.90	75.07

Run 1 (continued)

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
20-Oct-94	01:53 PM	0.00	127.95	8.00	75.10
20-Oct-94	01:54 PM	0.02	161.33	7.23	71.77
20-Oct-94	01:55 PM	0.00	163.80	7.03	69.37
20-Oct-94	01:56 PM	0.02	146.05	7.83	68.93
20-Oct-94	01:57 PM	0.03	173.77	7.20	69.63
20-Oct-94	01:58 PM	0.00	170.93	6.47	70.80
20-Oct-94	01:59 PM	0.00	128.93	6.63	70.73
20-Oct-94	02:00 PM	0.00	128.12	8.00	70.33
20-Oct-94	02:01 PM	0.08	192.83	6.87	69.87
20-Oct-94	02:02 PM	0.03	180.93	6.50	69.10
20-Oct-94	02:03 PM	0.02	147.14	7.40	69.96

Run 2

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
21-Oct-94	05:34 AM	0.20	69.30	6.60	64.30
21-Oct-94	05:35 AM	0.20	69.62	6.57	66.60
21-Oct-94	05:36 AM	0.20	69.63	6.20	65.10
21-Oct-94	05:37 AM	0.18	68.80	6.17	63.33
21-Oct-94	05:38 AM	0.13	69.48	6.27	62.67
21-Oct-94	05:39 AM	0.18	70.23	6.03	62.70
21-Oct-94	05:40 AM	0.15	70.52	5.90	62.80
21-Oct-94	05:41 AM	0.13	70.53	5.93	61.87
21-Oct-94	05:42 AM	0.12	70.75	6.00	63.93
21-Oct-94	05:43 AM	0.10	70.10	6.13	64.80
21-Oct-94	05:44 AM	0.10	69.93	6.23	65.57
21-Oct-94	05:45 AM	0.07	69.67	6.20	65.50
21-Oct-94	05:46 AM	0.07	69.48	6.30	65.83
21-Oct-94	05:47 AM	0.03	69.68	6.33	64.00
21-Oct-94	05:48 AM	0.00	69.68	6.10	62.93
21-Oct-94	05:49 AM	0.02	69.65	6.13	62.87
21-Oct-94	05:50 AM	0.05	69.85	6.20	63.17
21-Oct-94	05:51 AM	0.02	70.53	6.43	63.43
21-Oct-94	05:52 AM	0.03	70.52	6.63	65.83
21-Oct-94	05:53 AM	0.00	69.73	6.70	65.03
21-Oct-94	05:54 AM	0.05	67.65	6.83	66.50
21-Oct-94	05:55 AM	0.02	69.68	6.83	67.57
21-Oct-94	05:56 AM	0.00	69.32	6.57	67.37
21-Oct-94	05:57 AM	0.02	68.62	6.53	65.07
21-Oct-94	05:58 AM	0.05	69.30	6.10	62.57
21-Oct-94	05:59 AM	0.05	68.95	6.03	62.10
21-Oct-94	06:00 AM	0.07	70.87	5.97	62.83
21-Oct-94	06:01 AM	0.07	70.70	6.20	63.53
21-Oct-94	06:02 AM	0.08	70.88	6.17	66.17
21-Oct-94	06:03 AM	0.08	70.28	6.13	65.53
21-Oct-94	06:04 AM	0.08	68.13	6.07	65.10
21-Oct-94	06:05 AM	0.05	69.13	6.03	67.00
21-Oct-94	06:06 AM	0.03	69.48	5.87	66.60
21-Oct-94	06:07 AM	0.02	68.95	5.77	64.77
21-Oct-94	06:08 AM	0.08	69.48	5.57	62.70
21-Oct-94	06:09 AM	0.10	69.32	5.60	62.20
21-Oct-94	06:10 AM	0.12	70.55	5.63	62.63
21-Oct-94	06:11 AM	0.10	70.92	5.67	63.23
21-Oct-94	06:12 AM	0.10	70.55	5.83	65.00
21-Oct-94	06:13 AM	0.10	70.07	6.03	66.03
21-Oct-94	06:14 AM	0.10	69.65	6.20	67.00
21-Oct-94	06:15 AM	0.10	69.78	6.30	68.50
21-Oct-94	06:16 AM	0.10	71.25	6.33	69.33
21-Oct-94	06:17 AM	0.10	71.58	6.10	67.53
21-Oct-94	06:18 AM	0.08	72.13	6.10	66.60
21-Oct-94	06:19 AM	0.08	72.67	6.10	66.03
21-Oct-94	06:20 AM	0.05	72.67	6.13	66.23
21-Oct-94	06:21 AM	0.07	73.72	6.43	67.00
21-Oct-94	06:22 AM	0.07	73.73	6.70	69.37
21-Oct-94	06:23 AM	0.03	73.22	6.63	69.93
21-Oct-94	06:24 AM	0.05	69.73	6.47	67.67

RUN 2 (continued)

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
21-Oct-94	06:25 AM	0.02	67.62	6.23	66.47
21-Oct-94	06:26 AM	0.05	64.97	5.93	62.13
21-Oct-94	06:27 AM	0.03	64.13	5.87	60.37
21-Oct-94	06:28 AM	0.03	68.28	5.57	61.13
21-Oct-94	06:29 AM	0.05	70.27	5.50	62.37
21-Oct-94	06:30 AM	0.03	73.40	5.93	64.63
21-Oct-94	06:31 AM	0.05	73.88	5.87	64.90
21-Oct-94	06:32 AM	0.00	71.97	5.90	66.13
21-Oct-94	06:33 AM	0.02	71.07	5.97	67.57
21-Oct-94	06:34 AM	0.00	69.98	5.97	68.27
21-Oct-94	06:35 AM	0.00	69.67	5.90	68.80
21-Oct-94	06:36 AM	0.05	69.33	5.80	68.27
21-Oct-94	06:37 AM	0.02	69.10	5.43	65.60
21-Oct-94	06:38 AM	0.03	69.68	5.30	63.20
21-Oct-94	06:39 AM	0.08	70.52	5.20	62.53
21-Oct-94	06:40 AM	0.08	70.55	5.30	62.87
21-Oct-94	06:41 AM	0.10	70.55	5.50	63.47
21-Oct-94	06:42 AM	0.03	71.60	5.83	66.13
21-Oct-94	06:43 AM	0.02	70.62	6.00	68.30
21-Oct-94	06:44 AM	0.00	69.35	6.03	69.30
21-Oct-94	06:45 AM	0.00	68.63	6.33	70.00
21-Oct-94	06:46 AM	0.00	68.62	5.97	69.43
21-Oct-94	06:47 AM	0.05	68.12	5.87	66.07
21-Oct-94	06:48 AM	0.05	67.60	5.50	64.70

Run 3

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
23-Oct-94	11:03 AM	0.12	99.42	10.90	66.87
23-Oct-94	11:04 AM	0.10	102.70	10.70	66.10
23-Oct-94	11:05 AM	0.10	104.65	10.90	67.07
23-Oct-94	11:06 AM	0.12	106.47	11.50	69.13
23-Oct-94	11:07 AM	0.10	115.07	11.23	70.40
23-Oct-94	11:08 AM	0.10	114.60	11.73	72.07
23-Oct-94	11:09 AM	0.10	121.90	11.73	72.83
23-Oct-94	11:10 AM	0.12	126.85	11.57	71.87
23-Oct-94	11:11 AM	0.15	132.68	11.17	70.33
23-Oct-94	11:12 AM	0.13	143.87	11.07	68.57
23-Oct-94	11:13 AM	0.12	142.53	11.43	68.07
23-Oct-94	11:14 AM	0.18	167.08	10.47	67.93
23-Oct-94	11:15 AM	0.13	156.48	9.97	68.33
23-Oct-94	11:16 AM	0.10	142.63	9.80	69.60
23-Oct-94	11:17 AM	0.15	144.98	10.40	71.10
23-Oct-94	11:18 AM	0.17	159.35	10.10	71.90
23-Oct-94	11:19 AM	0.15	147.17	9.97	72.40
23-Oct-94	11:20 AM	0.12	142.68	10.17	71.97
23-Oct-94	11:21 AM	0.10	150.50	10.00	71.83
23-Oct-94	11:22 AM	0.10	147.65	9.63	71.17
23-Oct-94	11:23 AM	0.12	139.50	9.83	71.30
23-Oct-94	11:24 AM	0.17	138.70	10.10	71.53
23-Oct-94	11:25 AM	0.20	154.12	9.47	70.70
23-Oct-94	11:26 AM	0.18	146.97	9.93	70.67
23-Oct-94	11:27 AM	0.17	151.67	9.63	70.87
23-Oct-94	11:28 AM	0.17	150.02	9.13	71.77
23-Oct-94	11:29 AM	0.13	136.53	8.70	72.20
23-Oct-94	11:30 AM	0.17	129.38	8.57	72.30
23-Oct-94	11:31 AM	0.12	125.52	8.90	73.23
23-Oct-94	11:32 AM	0.15	129.18	8.57	72.77
23-Oct-94	11:33 AM	0.03	129.75	8.67	72.67
23-Oct-94	11:34 AM	-0.18	131.03	8.53	72.30
23-Oct-94	11:35 AM	-0.13	132.72	8.73	72.97
23-Oct-94	11:36 AM	-0.12	139.68	9.30	72.07
23-Oct-94	11:37 AM	-0.10	129.85	8.47	72.27
23-Oct-94	11:38 AM	-0.10	124.53	8.60	72.67
23-Oct-94	11:39 AM	-0.10	124.03	8.80	73.20
23-Oct-94	11:40 AM	-0.10	128.92	8.47	73.37
23-Oct-94	11:41 AM	-0.12	124.53	9.00	72.13
23-Oct-94	11:42 AM	-0.17	132.35	8.93	70.83
23-Oct-94	11:43 AM	-0.17	153.15	8.77	71.10
23-Oct-94	11:44 AM	-0.18	140.15	8.67	71.37
23-Oct-94	11:45 AM	-0.10	141.07	9.90	71.93
23-Oct-94	11:46 AM	-0.13	180.02	9.27	73.63
23-Oct-94	11:47 AM	-0.10	176.87	8.57	74.70
23-Oct-94	11:48 AM	20.35	150.30	8.83	74.73
23-Oct-94	11:49 AM	26.33	146.70	8.77	75.10
23-Oct-94	11:50 AM	21.78	159.48	8.43	74.37
23-Oct-94	11:51 AM	32.58	155.83	8.17	72.80
23-Oct-94	11:52 AM	2.73	144.85	8.10	71.40
23-Oct-94	11:53 AM	18.50	142.68	9.17	71.87

Run 3 (continued)

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
23-Oct-94	11:54 AM	25.97	169.67	9.00	71.57
23-Oct-94	11:55 AM	20.42	173.30	9.17	71.87
23-Oct-94	11:56 AM	2.43	177.80	9.20	71.50
23-Oct-94	11:57 AM	12.85	175.97	8.70	71.87
23-Oct-94	11:58 AM	11.28	174.03	9.57	71.90
23-Oct-94	11:59 AM	18.48	197.23	8.87	71.47
23-Oct-94	12:00 PM	0.45	179.80	8.80	71.87
23-Oct-94	12:01 PM	21.28	159.63	9.07	72.77
23-Oct-94	12:02 PM	38.05	149.85	8.73	73.10
23-Oct-94	12:03 PM	8.63	140.85	8.53	72.77
23-Oct-94	12:04 PM	1.40	143.00	8.80	72.57
23-Oct-94	12:05 PM	-0.10	162.95	8.60	71.97
23-Oct-94	12:06 PM	-0.15	172.18	8.80	69.40
23-Oct-94	12:07 PM	-0.12	189.43	8.30	69.23
23-Oct-94	12:08 PM	9.27	177.97	7.93	69.93
23-Oct-94	12:09 PM	0.70	156.32	8.47	70.17
23-Oct-94	12:10 PM	2.10	160.60	8.33	69.83
23-Oct-94	12:11 PM	5.38	168.70	8.07	70.17
23-Oct-94	12:12 PM	-0.17	150.28	8.30	70.07
23-Oct-94	12:13 PM	-0.13	151.93	9.63	70.43
23-Oct-94	12:14 PM	3.72	203.53	8.47	70.77
23-Oct-94	12:15 PM	16.68	187.42	9.00	71.13
23-Oct-94	12:16 PM	5.92	196.72	8.27	72.10
23-Oct-94	12:17 PM	0.72	158.12	8.40	73.23
23-Oct-94	12:18 PM	0.02	146.35	8.63	73.77
23-Oct-94	12:19 PM	-0.50	146.83	8.80	73.87
23-Oct-94	12:20 PM	36.43	152.82	8.37	72.93
23-Oct-94	12:21 PM	2.53	152.27	8.90	70.83
23-Oct-94	12:22 PM	3.45	188.95	8.10	69.87
23-Oct-94	12:23 PM	-0.03	159.93	8.47	69.83
23-Oct-94	12:24 PM	-1.60	164.62	8.53	69.23
23-Oct-94	12:25 PM	-0.17	166.68	8.23	69.87
23-Oct-94	12:26 PM	-0.12	154.23	8.13	71.07
23-Oct-94	12:27 PM	-0.10	138.53	8.33	71.47
23-Oct-94	12:28 PM	-0.13	156.97	9.40	71.50
23-Oct-94	12:29 PM	-0.10	196.58	8.57	72.47
23-Oct-94	12:30 PM	-0.13	171.37	8.13	72.20
23-Oct-94	12:31 PM	14.65	155.62	7.87	70.57
23-Oct-94	12:32 PM	-0.17	138.65	8.07	67.97
23-Oct-94	12:33 PM	-0.15	143.48	7.97	66.97
23-Oct-94	12:34 PM	-0.12	159.82	8.13	68.97
23-Oct-94	12:35 PM	8.25	158.63	8.17	70.23
23-Oct-94	12:36 PM	1.47	158.80	8.30	71.67
23-Oct-94	12:37 PM	10.28	162.62	8.13	71.47
23-Oct-94	12:38 PM	-0.17	139.80	8.17	71.93
23-Oct-94	12:39 PM	-0.10	135.52	8.67	73.20
23-Oct-94	12:40 PM	24.92	158.97	8.27	72.70
23-Oct-94	12:41 PM	5.65	152.32	7.93	70.50
23-Oct-94	12:42 PM	-0.17	142.97	8.07	69.43
23-Oct-94	12:43 PM	10.23	146.67	8.33	69.80
23-Oct-94	12:44 PM	-0.08	163.23	8.67	69.00

Run 3 (continued)

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
23-Oct-94	12:45 PM	0.08	191.25	8.10	69.27
23-Oct-94	12:46 PM	5.78	185.58	9.33	70.47
23-Oct-94	12:47 PM	1.60	218.32	8.13	71.67
23-Oct-94	12:48 PM	16.58	167.73	8.27	72.43
23-Oct-94	12:49 PM	-0.07	150.12	8.90	72.90
23-Oct-94	12:50 PM	-0.10	181.10	8.67	72.10
23-Oct-94	12:51 PM	-0.10	178.97	8.10	70.10
23-Oct-94	12:52 PM	-0.12	156.13	7.80	69.13
23-Oct-94	12:53 PM	9.20	139.30	8.67	68.33
23-Oct-94	12:54 PM	0.43	164.73	8.40	68.97
23-Oct-94	12:55 PM	12.60	170.50	9.00	69.17
23-Oct-94	12:56 PM	13.15	198.57	8.93	70.90
23-Oct-94	12:57 PM	23.55	191.23	8.53	72.83
23-Oct-94	12:58 PM	6.42	174.80	8.47	73.50
23-Oct-94	12:59 PM	0.08	152.78	8.70	74.17
23-Oct-94	01:00 PM	0.08	157.90	8.87	72.57
23-Oct-94	01:01 PM	0.08	191.37	9.27	69.97
23-Oct-94	01:02 PM	0.12	249.22	8.23	69.10
23-Oct-94	01:03 PM	0.10	210.92	8.17	68.33
23-Oct-94	01:04 PM	0.10	204.03	7.90	67.97
23-Oct-94	01:05 PM	0.10	208.67	7.87	68.53
23-Oct-94	01:06 PM	0.10	192.63	9.13	71.07
23-Oct-94	01:07 PM	0.12	249.72	8.63	73.10
23-Oct-94	01:08 PM	0.08	240.35	9.60	72.93
23-Oct-94	01:09 PM	0.08	262.45	9.57	72.83
23-Oct-94	01:10 PM	0.10	294.58	9.40	71.13
23-Oct-94	01:11 PM	0.15	317.98	7.70	67.90
23-Oct-94	01:12 PM	0.15	259.65	8.00	67.40
23-Oct-94	01:13 PM	0.10	243.77	8.27	68.50
23-Oct-94	01:14 PM	0.12	246.93	6.90	68.50
23-Oct-94	01:15 PM	0.10	215.45	6.97	67.30
23-Oct-94	01:16 PM	0.10	191.35	6.50	69.07
23-Oct-94	01:17 PM	0.10	171.23	6.60	70.23
23-Oct-94	01:18 PM	0.10	157.83	6.80	71.17
23-Oct-94	01:19 PM	0.08	148.72	6.50	71.27
23-Oct-94	01:20 PM	0.07	138.77	6.30	70.57
23-Oct-94	01:21 PM	0.08	138.23	6.17	68.80
23-Oct-94	01:22 PM	0.10	149.85	5.97	68.03
23-Oct-94	01:23 PM	0.07	151.90	6.20	67.40
23-Oct-94	01:24 PM	0.08	141.72	5.63	67.27
23-Oct-94	01:25 PM	0.08	131.28	5.63	67.40
23-Oct-94	01:26 PM	0.07	126.53	5.97	70.00
23-Oct-94	01:27 PM	0.08	138.28	5.87	71.77
23-Oct-94	01:28 PM	0.12	138.08	5.93	72.60
23-Oct-94	01:29 PM	0.08	128.43	6.03	72.67
23-Oct-94	01:30 PM	0.03	123.93	6.60	72.37
23-Oct-94	01:31 PM	0.05	122.00	8.07	70.07
23-Oct-94	01:32 PM	0.03	135.88	8.47	68.60
23-Oct-94	01:33 PM	0.03	142.33	8.10	67.70

Run 4

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
24-Oct-94	02:48 AM	0.35	74.62	9.63	65.30
24-Oct-94	02:49 AM	0.28	72.15	9.37	66.03
24-Oct-94	02:50 AM	0.22	74.93	9.30	65.73
24-Oct-94	02:51 AM	0.18	75.60	9.40	66.17
24-Oct-94	02:52 AM	0.15	75.77	9.47	66.93
24-Oct-94	02:53 AM	0.13	75.97	9.53	66.23
24-Oct-94	02:54 AM	0.22	74.58	9.73	66.50
24-Oct-94	02:55 AM	0.20	74.53	9.57	66.13
24-Oct-94	02:56 AM	0.18	73.98	9.70	66.00
24-Oct-94	02:57 AM	0.18	73.70	9.40	66.07
24-Oct-94	02:58 AM	0.12	73.82	9.13	64.87
24-Oct-94	02:59 AM	0.17	75.10	9.07	63.27
24-Oct-94	03:00 AM	0.10	75.75	9.30	63.23
24-Oct-94	03:01 AM	0.25	77.10	9.47	63.33
24-Oct-94	03:02 AM	0.22	76.93	9.77	65.87
24-Oct-94	03:03 AM	0.17	77.48	9.67	66.97
24-Oct-94	03:04 AM	0.13	76.95	9.53	66.50
24-Oct-94	03:05 AM	0.08	75.77	9.60	66.47
24-Oct-94	03:06 AM	0.10	74.78	9.30	67.20
24-Oct-94	03:07 AM	0.08	75.60	8.73	64.10
24-Oct-94	03:08 AM	0.10	74.95	8.67	63.40
24-Oct-94	03:09 AM	0.07	75.22	8.90	65.37
24-Oct-94	03:10 AM	0.00	77.88	8.87	65.47
24-Oct-94	03:11 AM	0.02	78.98	9.03	65.80
24-Oct-94	03:12 AM	-0.07	78.53	9.50	69.93
24-Oct-94	03:13 AM	-0.03	80.23	9.57	71.70
24-Oct-94	03:14 AM	-0.05	79.33	9.63	71.80
24-Oct-94	03:15 AM	-0.07	77.08	9.73	73.13
24-Oct-94	03:16 AM	-0.08	77.60	9.60	72.83
24-Oct-94	03:17 AM	0.02	77.45	9.60	69.43
24-Oct-94	03:18 AM	0.02	77.10	9.40	67.47
24-Oct-94	03:19 AM	-0.03	78.50	9.30	66.37
24-Oct-94	03:20 AM	-0.07	79.35	9.20	65.70
24-Oct-94	03:21 AM	0.02	79.00	9.30	66.57
24-Oct-94	03:22 AM	-0.03	80.60	9.60	69.40
24-Oct-94	03:23 AM	-0.03	80.60	9.80	71.67
24-Oct-94	03:24 AM	-0.07	80.07	9.83	72.63
24-Oct-94	03:25 AM	-0.03	79.38	9.60	73.03
24-Oct-94	03:26 AM	-0.05	78.48	9.37	72.80
24-Oct-94	03:27 AM	-0.02	78.35	8.80	67.83
24-Oct-94	03:28 AM	-0.10	75.73	8.77	64.37
24-Oct-94	03:29 AM	-0.08	75.07	9.07	66.10
24-Oct-94	03:30 AM	-0.10	78.85	9.03	67.20
24-Oct-94	03:31 AM	-0.12	80.58	9.00	67.93
24-Oct-94	03:32 AM	-0.07	80.60	9.67	70.00
24-Oct-94	03:33 AM	-0.07	80.60	9.77	70.97
24-Oct-94	03:34 AM	-0.08	79.52	9.90	71.57
24-Oct-94	03:35 AM	-0.12	78.47	9.83	71.60
24-Oct-94	03:36 AM	-0.12	77.60	9.70	71.00
24-Oct-94	03:37 AM	-0.13	77.43	9.50	69.03
24-Oct-94	03:38 AM	-0.12	76.93	9.33	67.17

Run 4 (continued)

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
24-Oct-94	03:39 AM	-0.12	76.55	9.27	66.23
24-Oct-94	03:40 AM	-0.08	77.60	9.30	66.47
24-Oct-94	03:41 AM	-0.10	78.18	9.30	66.57
24-Oct-94	03:42 AM	-0.05	78.50	9.67	68.10
24-Oct-94	03:43 AM	-0.10	78.35	9.60	69.80
24-Oct-94	03:44 AM	-0.05	77.62	9.53	71.00
24-Oct-94	03:45 AM	-0.10	77.62	9.53	71.03
24-Oct-94	03:46 AM	-0.10	76.77	9.70	70.97
24-Oct-94	03:47 AM	-0.07	76.93	9.43	69.10
24-Oct-94	03:48 AM	-0.07	76.60	9.07	67.13
24-Oct-94	03:49 AM	-0.08	76.27	8.83	65.03
24-Oct-94	03:50 AM	-0.10	75.60	8.87	63.83
24-Oct-94	03:51 AM	-0.10	75.93	9.37	65.80
24-Oct-94	03:52 AM	-0.10	78.35	9.70	68.17
24-Oct-94	03:53 AM	-0.10	79.05	9.63	70.40
24-Oct-94	03:54 AM	-0.08	78.37	9.70	71.17
24-Oct-94	03:55 AM	-0.10	77.60	9.57	71.07
24-Oct-94	03:56 AM	-0.10	77.80	9.63	70.60
24-Oct-94	03:57 AM	-0.10	78.20	9.37	67.80
24-Oct-94	03:58 AM	-0.10	77.62	9.07	63.33
24-Oct-94	03:59 AM	-0.15	78.18	8.97	64.63
24-Oct-94	04:00 AM	-0.13	78.50	8.77	65.73
24-Oct-94	04:01 AM	-0.10	78.35	8.90	65.97
24-Oct-94	04:02 AM	-0.12	78.35	9.10	67.37
24-Oct-94	04:03 AM	-0.13	78.87	9.00	69.60
24-Oct-94	04:04 AM	-0.18	78.87	9.13	70.67
24-Oct-94	04:05 AM	-0.18	78.07	9.03	71.20
24-Oct-94	04:06 AM	-0.18	77.65	9.03	71.57
24-Oct-94	04:07 AM	-0.17	77.62	8.63	69.30
24-Oct-94	04:08 AM	-0.10	77.63	8.37	67.33
24-Oct-94	04:09 AM	-0.15	78.07	8.50	66.67
24-Oct-94	04:10 AM	-0.13	79.03	8.70	66.57
24-Oct-94	04:11 AM	-0.10	79.55	8.77	66.03
24-Oct-94	04:12 AM	-0.13	79.53	9.20	68.03
24-Oct-94	04:13 AM	-0.17	79.53	9.37	70.77
24-Oct-94	04:14 AM	-0.17	79.00	9.60	71.90
24-Oct-94	04:15 AM	-0.15	77.77	9.47	72.27
24-Oct-94	04:16 AM	-0.18	77.10	9.50	72.67
24-Oct-94	04:17 AM	-0.18	77.60	8.87	70.03
24-Oct-94	04:18 AM	-0.13	76.60	8.40	67.53
24-Oct-94	04:19 AM	-0.17	77.73	8.23	66.27
24-Oct-94	04:20 AM	-0.20	79.05	8.17	65.30
24-Oct-94	04:21 AM	-0.22	79.03	8.23	65.20
24-Oct-94	04:22 AM	-0.23	79.02	8.43	68.03
24-Oct-94	04:23 AM	-0.25	80.25	8.43	70.17
24-Oct-94	04:24 AM	-0.23	79.37	8.67	71.03
24-Oct-94	04:25 AM	-0.23	78.50	8.70	71.63
24-Oct-94	04:26 AM	-0.28	78.50	8.73	71.73
24-Oct-94	04:27 AM	-0.23	77.75	8.37	70.30
24-Oct-94	04:28 AM	-0.28	78.20	8.50	68.97
24-Oct-94	04:29 AM	-0.23	78.85	8.43	68.20

Run 4 (continued)

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
24-Oct-94	04:30 AM	-0.20	78.85	8.37	67.50
24-Oct-94	04:31 AM	-0.27	78.50	8.57	68.33
24-Oct-94	04:32 AM	-0.30	79.55	8.57	68.77
24-Oct-94	04:33 AM	-0.25	79.57	8.73	69.30
24-Oct-94	04:34 AM	-0.30	79.57	8.70	70.43
24-Oct-94	04:35 AM	-0.25	79.40	8.47	71.13
24-Oct-94	04:36 AM	-0.30	78.50	8.37	71.30
24-Oct-94	04:37 AM	-0.30	78.50	8.43	71.70
24-Oct-94	04:38 AM	-0.28	78.50	8.30	71.77
24-Oct-94	04:39 AM	-0.30	78.50	8.43	71.17
24-Oct-94	04:40 AM	-0.30	77.92	8.27	70.30

Run 5

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
26-Oct-94	12:07 PM	0.40	164.93	9.53	53.57
26-Oct-94	12:08 PM	0.38	157.35	9.40	54.17
26-Oct-94	12:09 PM	0.40	148.18	9.13	53.73
26-Oct-94	12:10 PM	0.38	143.20	9.00	53.57
26-Oct-94	12:11 PM	0.38	140.52	9.17	53.83
26-Oct-94	12:12 PM	0.38	146.52	9.20	53.47
26-Oct-94	12:13 PM	0.37	142.17	9.17	53.77
26-Oct-94	12:14 PM	0.33	146.27	9.27	54.40
26-Oct-94	12:15 PM	0.40	170.68	9.67	54.93
26-Oct-94	12:16 PM	0.40	171.52	9.10	55.00
26-Oct-94	12:17 PM	0.35	155.00	8.93	54.97
26-Oct-94	12:18 PM	0.37	152.02	8.93	55.67
26-Oct-94	12:19 PM	0.30	146.03	8.77	55.77
26-Oct-94	12:20 PM	0.33	144.17	9.07	56.20
26-Oct-94	12:21 PM	0.40	173.50	10.73	56.57
26-Oct-94	12:22 PM	0.37	221.40	9.57	57.00
26-Oct-94	12:23 PM	0.32	175.15	9.13	56.70
26-Oct-94	12:24 PM	0.30	156.82	9.83	56.23
26-Oct-94	12:25 PM	0.35	215.95	9.87	55.50
26-Oct-94	12:26 PM	0.30	185.62	9.40	55.73
26-Oct-94	12:27 PM	0.30	174.00	9.07	56.07
26-Oct-94	12:28 PM	0.30	153.77	8.93	56.23
26-Oct-94	12:29 PM	0.30	146.00	8.97	56.13
26-Oct-94	12:30 PM	0.30	157.12	9.10	56.33
26-Oct-94	12:31 PM	0.30	149.95	8.77	56.50
26-Oct-94	12:32 PM	0.30	143.68	9.17	56.23
26-Oct-94	12:33 PM	0.32	177.98	9.27	55.57
26-Oct-94	12:34 PM	0.32	159.93	8.97	54.03
26-Oct-94	12:35 PM	0.30	153.30	9.40	54.83
26-Oct-94	12:36 PM	0.33	180.43	9.07	55.83
26-Oct-94	12:37 PM	0.32	156.63	9.47	56.00
26-Oct-94	12:38 PM	0.35	184.43	10.10	56.23
26-Oct-94	12:39 PM	0.40	250.63	9.90	56.17
26-Oct-94	12:40 PM	0.35	221.68	9.33	56.50
26-Oct-94	12:41 PM	0.32	208.02	9.07	56.57
26-Oct-94	12:42 PM	0.32	174.48	8.87	56.67
26-Oct-94	12:43 PM	0.37	179.62	9.23	56.90
26-Oct-94	12:44 PM	0.30	175.98	8.57	56.50
26-Oct-94	12:45 PM	0.30	153.90	8.63	56.47
26-Oct-94	12:46 PM	0.30	161.90	9.37	57.10
26-Oct-94	12:47 PM	0.33	190.27	9.10	57.17
26-Oct-94	12:48 PM	0.35	176.98	9.27	57.00
26-Oct-94	12:49 PM	0.35	185.92	9.50	57.60
26-Oct-94	12:50 PM	0.35	183.47	9.10	57.87
26-Oct-94	12:51 PM	0.35	180.18	9.27	57.13
26-Oct-94	12:52 PM	0.33	163.90	8.90	57.07
26-Oct-94	12:53 PM	0.33	161.40	9.63	57.73
26-Oct-94	12:54 PM	0.38	203.22	10.20	58.23
26-Oct-94	12:55 PM	0.47	375.02	10.13	58.33
26-Oct-94	12:56 PM	0.40	212.45	9.67	57.93
26-Oct-94	12:57 PM	0.40	204.97	10.03	58.40

Run 5 (continued)

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
26-Oct-94	12:58 PM	0.40	197.22	9.60	59.03
26-Oct-94	12:59 PM	0.38	183.38	9.40	58.93
26-Oct-94	01:00 PM	0.40	170.47	10.03	59.53
26-Oct-94	01:01 PM	0.48	218.97	10.40	59.57
26-Oct-94	01:02 PM	0.42	228.75	10.33	59.90
26-Oct-94	01:03 PM	0.42	229.35	10.03	59.13
26-Oct-94	01:04 PM	0.43	229.53	9.33	58.27
26-Oct-94	01:05 PM	0.42	189.38	9.53	58.67
26-Oct-94	01:06 PM	0.40	184.40	9.33	57.47
26-Oct-94	01:07 PM	0.40	175.67	9.13	58.50
26-Oct-94	01:08 PM	0.38	155.78	9.27	58.73
26-Oct-94	01:09 PM	0.40	163.77	9.20	59.33
26-Oct-94	01:10 PM	0.40	160.08	9.53	59.83
26-Oct-94	01:11 PM	0.40	168.02	9.17	60.37
26-Oct-94	01:12 PM	0.40	150.97	8.93	60.37
26-Oct-94	01:13 PM	0.40	143.45	9.33	60.43
26-Oct-94	01:14 PM	0.43	163.25	9.63	60.17
26-Oct-94	01:15 PM	0.48	187.42	9.30	58.30
26-Oct-94	01:16 PM	0.45	168.87	8.93	57.80
26-Oct-94	01:17 PM	0.43	147.45	9.03	57.93
26-Oct-94	01:18 PM	0.43	138.70	9.00	57.80
26-Oct-94	01:19 PM	0.40	145.67	9.10	58.47
26-Oct-94	01:20 PM	0.47	141.15	9.50	59.33
26-Oct-94	01:21 PM	0.50	175.32	9.40	59.53
26-Oct-94	01:22 PM	0.47	151.62	9.43	58.47
26-Oct-94	01:23 PM	0.52	184.20	10.43	58.90
26-Oct-94	01:24 PM	0.50	187.08	9.93	58.83
26-Oct-94	01:25 PM	0.50	218.52	9.77	57.90
26-Oct-94	01:26 PM	0.47	195.68	9.63	57.77
26-Oct-94	01:27 PM	0.48	205.60	9.47	54.63
26-Oct-94	01:28 PM	0.50	189.73	9.70	56.13
26-Oct-94	01:29 PM	0.50	186.60	9.83	57.57
26-Oct-94	01:30 PM	0.58	219.42	9.27	57.90
26-Oct-94	01:31 PM	0.60	184.73	8.80	57.77
26-Oct-94	01:32 PM	0.60	160.93	8.83	57.73
26-Oct-94	01:33 PM	0.65	169.88	8.83	57.90
26-Oct-94	01:34 PM	0.62	169.98	9.07	58.40
26-Oct-94	01:35 PM	0.67	187.28	9.07	59.00
26-Oct-94	01:36 PM	0.62	203.68	8.53	58.47
26-Oct-94	01:37 PM	0.62	169.37	8.30	58.33
26-Oct-94	01:38 PM	0.53	150.62	8.13	58.77
26-Oct-94	01:39 PM	0.57	146.32	8.83	59.37
26-Oct-94	01:40 PM	0.52	175.00	9.10	60.33
26-Oct-94	01:41 PM	0.53	227.38	9.47	61.20
26-Oct-94	01:42 PM	0.53	235.45	9.57	61.47
26-Oct-94	01:43 PM	0.53	272.60	9.30	61.27
26-Oct-94	01:44 PM	0.50	230.80	8.57	60.53
26-Oct-94	01:45 PM	0.50	181.93	8.30	58.37
26-Oct-94	01:46 PM	0.48	180.43	8.13	56.77
26-Oct-94	01:47 PM	0.50	212.40	8.43	55.87
26-Oct-94	01:48 PM	0.48	174.63	9.03	56.17

Run 5 (continued)

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
26-Oct-94	01:49 PM	0.52	257.80	9.07	56.90
26-Oct-94	01:50 PM	0.52	249.18	9.60	58.43
26-Oct-94	01:51 PM	0.48	235.40	9.63	58.73
26-Oct-94	01:52 PM	0.50	274.05	10.03	59.77
26-Oct-94	01:53 PM	0.50	275.03	9.97	60.77
26-Oct-94	01:54 PM	0.45	238.55	8.90	60.47
26-Oct-94	01:55 PM	0.43	218.23	9.43	58.73
26-Oct-94	01:56 PM	0.48	254.20	9.70	57.80
26-Oct-94	01:57 PM	0.50	265.23	9.77	57.17
26-Oct-94	01:58 PM	0.55	284.15	10.27	56.90
26-Oct-94	01:59 PM	0.57	321.13	9.63	55.53
26-Oct-94	02:00 PM	0.50	270.25	9.83	57.00
26-Oct-94	02:01 PM	0.48	270.73	9.33	57.87
26-Oct-94	02:02 PM	0.52	229.63	9.23	58.30
26-Oct-94	02:03 PM	0.50	235.48	10.07	58.90
26-Oct-94	02:04 PM	0.50	269.43	8.97	58.77
26-Oct-94	02:05 PM	0.47	230.03	9.83	57.87
26-Oct-94	02:06 PM	0.50	283.48	8.87	57.17
26-Oct-94	02:07 PM	0.45	213.28	9.60	56.57
26-Oct-94	02:08 PM	0.52	268.98	9.30	55.30
26-Oct-94	02:09 PM	0.47	235.20	8.57	56.23
26-Oct-94	02:10 PM	0.45	197.20	9.73	57.43
26-Oct-94	02:11 PM	0.42	221.62	8.77	57.77
26-Oct-94	02:12 PM	0.40	193.92	8.90	58.00
26-Oct-94	02:13 PM	0.40	194.67	9.17	58.00
26-Oct-94	02:14 PM	0.38	207.13	7.90	57.57
26-Oct-94	02:15 PM	0.38	160.42	7.40	56.13
26-Oct-94	02:16 PM	0.40	142.47	7.30	55.27
26-Oct-94	02:17 PM	0.40	135.97	7.17	54.67
26-Oct-94	02:18 PM	0.42	138.32	7.23	54.53
26-Oct-94	02:19 PM	0.40	139.97	7.63	54.73
26-Oct-94	02:20 PM	0.35	97.00	7.83	55.83
26-Oct-94	02:21 PM	0.40	142.68	7.57	57.30
26-Oct-94	02:22 PM	0.40	154.38	8.20	58.17
26-Oct-94	02:23 PM	0.40	154.10	7.90	58.70
26-Oct-94	02:24 PM	0.40	139.00	7.50	58.40
26-Oct-94	02:25 PM	0.38	130.97	7.10	57.53
26-Oct-94	02:26 PM	0.32	130.18	7.03	57.20
26-Oct-94	02:27 PM	0.37	142.28	7.57	58.83
26-Oct-94	02:28 PM	0.40	163.68	7.17	55.67
26-Oct-94	02:29 PM	0.40	139.45	7.13	55.37
26-Oct-94	02:30 PM	0.40	131.48	7.23	56.70
26-Oct-94	02:31 PM	0.43	134.15	7.47	57.57
26-Oct-94	02:32 PM	0.42	130.97	7.27	57.70
26-Oct-94	02:33 PM	0.40	124.62	7.13	57.13
26-Oct-94	02:34 PM	0.43	161.88	7.93	56.00
26-Oct-94	02:35 PM	0.37	149.10	7.33	54.77
26-Oct-94	02:36 PM	0.40	130.15	7.27	54.93
26-Oct-94	02:37 PM	0.38	121.72	7.23	55.13
26-Oct-94	02:38 PM	0.35	118.63	7.27	55.43
26-Oct-94	02:39 PM	0.32	120.55	7.37	55.23

Run 5 (continued)

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
26-Oct-94	02:40 PM	0.30	122.87	7.13	54.13
26-Oct-94	02:41 PM	0.30	117.70	7.17	53.80
26-Oct-94	02:42 PM	0.30	136.98	7.43	53.73
26-Oct-94	02:43 PM	0.28	128.18	6.83	53.83
26-Oct-94	02:44 PM	0.23	119.00	6.67	54.07
26-Oct-94	02:45 PM	0.25	115.03	6.63	56.57
26-Oct-94	02:46 PM	0.20	113.80	6.73	56.10
26-Oct-94	02:47 PM	0.22	112.60	7.27	54.17
26-Oct-94	02:48 PM	0.28	163.78	7.27	53.67
26-Oct-94	02:49 PM	0.28	184.77	7.77	54.00
26-Oct-94	02:50 PM	0.20	159.12	7.20	54.83
26-Oct-94	02:51 PM	0.20	137.87	7.40	55.13
26-Oct-94	02:52 PM	0.10	123.20	7.03	55.43
26-Oct-94	02:53 PM	0.10	112.73	7.00	54.83
26-Oct-94	02:54 PM	0.10	127.30	7.67	55.60
26-Oct-94	02:55 PM	0.13	163.13	8.00	55.63
26-Oct-94	02:56 PM	0.17	194.67	7.63	55.50
26-Oct-94	02:57 PM	0.10	146.37	6.93	55.67
26-Oct-94	02:58 PM	0.08	131.55	7.10	55.90
26-Oct-94	02:59 PM	0.08	122.55	6.93	55.20
26-Oct-94	03:00 PM	0.32	113.97	7.70	61.00
26-Oct-94	03:01 PM	0.50	112.60	8.50	82.55

Run 6

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
27-Oct-94	05:08 AM	0.20	77.65	9.53	45.77
27-Oct-94	05:09 AM	0.18	77.60	9.63	46.40
27-Oct-94	05:10 AM	0.23	76.65	9.70	47.60
27-Oct-94	05:11 AM	0.20	76.50	9.67	48.37
27-Oct-94	05:12 AM	0.25	75.67	9.70	48.83
27-Oct-94	05:13 AM	0.18	75.50	9.83	48.97
27-Oct-94	05:14 AM	0.18	75.15	9.80	48.73
27-Oct-94	05:15 AM	0.23	75.67	9.67	47.43
27-Oct-94	05:16 AM	0.27	76.33	9.27	46.60
27-Oct-94	05:17 AM	0.22	76.33	9.23	46.17
27-Oct-94	05:18 AM	0.23	77.50	9.37	46.43
27-Oct-94	05:19 AM	0.27	77.17	9.50	46.73
27-Oct-94	05:20 AM	0.27	77.00	9.70	47.40
27-Oct-94	05:21 AM	0.22	76.47	9.60	48.07
27-Oct-94	05:22 AM	0.25	76.33	9.67	48.23
27-Oct-94	05:23 AM	0.23	76.33	9.63	48.67
27-Oct-94	05:24 AM	0.22	76.67	9.70	49.13
27-Oct-94	05:25 AM	0.27	76.67	9.70	49.20
27-Oct-94	05:26 AM	0.28	76.18	9.87	49.20
27-Oct-94	05:27 AM	0.27	76.32	10.10	49.10
27-Oct-94	05:28 AM	0.25	76.00	10.10	49.23
27-Oct-94	05:29 AM	0.27	75.47	10.03	48.40
27-Oct-94	05:30 AM	0.25	79.43	10.00	48.70
27-Oct-94	05:31 AM	0.32	79.62	10.03	48.70
27-Oct-94	05:32 AM	0.30	79.62	10.17	48.60
27-Oct-94	05:33 AM	0.28	79.63	10.03	47.77
27-Oct-94	05:34 AM	0.28	79.48	10.20	47.30
27-Oct-94	05:35 AM	0.30	79.62	10.20	47.60
27-Oct-94	05:36 AM	0.28	79.28	10.33	47.93
27-Oct-94	05:37 AM	0.28	78.90	10.23	48.00
27-Oct-94	05:38 AM	0.27	78.58	10.07	48.10
27-Oct-94	05:39 AM	0.30	78.90	10.03	48.13
27-Oct-94	05:40 AM	0.28	78.12	9.97	47.97
27-Oct-94	05:41 AM	0.30	77.65	10.13	47.70
27-Oct-94	05:42 AM	0.32	78.12	9.97	47.67
27-Oct-94	05:43 AM	0.30	77.95	9.90	47.87
27-Oct-94	05:44 AM	0.28	77.32	9.93	47.73
27-Oct-94	05:45 AM	0.28	78.10	10.10	47.63
27-Oct-94	05:46 AM	0.30	77.95	10.17	48.07
27-Oct-94	05:47 AM	0.30	78.58	10.23	48.20
27-Oct-94	05:48 AM	0.28	77.95	10.10	48.60
27-Oct-94	05:49 AM	0.28	77.67	9.87	48.17
27-Oct-94	05:50 AM	0.25	78.12	10.03	48.07
27-Oct-94	05:51 AM	0.30	78.28	10.00	48.03
27-Oct-94	05:52 AM	0.25	78.25	9.90	47.83
27-Oct-94	05:53 AM	0.27	77.80	10.10	47.77
27-Oct-94	05:54 AM	0.30	78.58	10.03	48.10
27-Oct-94	05:55 AM	0.27	77.80	10.00	48.30
27-Oct-94	05:56 AM	0.28	77.33	10.30	48.97

Run 6 (continued)

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
27-Oct-94	05:57 AM	0.27	76.50	10.37	50.20
27-Oct-94	05:58 AM	0.27	75.98	10.30	50.87
27-Oct-94	05:59 AM	0.30	75.33	10.00	50.40
27-Oct-94	06:00 AM	0.30	76.22	9.80	48.50
27-Oct-94	06:01 AM	0.30	77.78	9.67	47.80
27-Oct-94	06:02 AM	0.30	77.95	9.57	47.33
27-Oct-94	06:03 AM	0.28	78.25	9.53	47.37
27-Oct-94	06:04 AM	0.28	78.58	9.63	47.70
27-Oct-94	06:05 AM	0.30	79.10	10.00	49.23
27-Oct-94	06:06 AM	0.28	77.98	10.10	50.07
27-Oct-94	06:07 AM	0.27	77.65	10.17	50.33
27-Oct-94	06:08 AM	0.30	77.35	10.13	50.60
27-Oct-94	06:09 AM	0.28	77.20	9.97	50.10
27-Oct-94	06:10 AM	0.28	77.18	9.97	49.20
27-Oct-94	06:11 AM	0.28	77.50	9.93	48.50
27-Oct-94	06:12 AM	0.28	77.83	9.83	48.47
27-Oct-94	06:13 AM	0.30	78.25	9.80	48.57
27-Oct-94	06:14 AM	0.28	78.58	9.77	48.63
27-Oct-94	06:15 AM	0.28	78.25	10.00	49.10
27-Oct-94	06:16 AM	0.28	77.95	10.00	49.63
27-Oct-94	06:17 AM	0.27	77.65	10.03	49.90
27-Oct-94	06:18 AM	0.27	76.32	10.00	50.03
27-Oct-94	06:19 AM	0.28	76.67	9.90	49.60
27-Oct-94	06:20 AM	0.27	76.50	9.80	48.27
27-Oct-94	06:21 AM	0.25	77.48	9.50	47.70
27-Oct-94	06:22 AM	0.28	77.78	9.70	48.00
27-Oct-94	06:23 AM	0.22	78.27	9.60	48.07
27-Oct-94	06:24 AM	0.23	78.10	9.77	48.00
27-Oct-94	06:25 AM	0.27	78.27	10.17	48.83
27-Oct-94	06:26 AM	0.22	77.00	10.07	49.40
27-Oct-94	06:27 AM	0.22	76.00	10.00	49.17
27-Oct-94	06:28 AM	0.23	76.50	9.97	49.53
27-Oct-94	06:29 AM	0.23	75.83	9.83	49.90
27-Oct-94	06:30 AM	0.23	76.02	9.60	48.07
27-Oct-94	06:31 AM	0.25	77.52	9.37	46.97
27-Oct-94	06:32 AM	0.27	77.67	9.40	46.50
27-Oct-94	06:33 AM	0.25	78.42	9.53	46.57
27-Oct-94	06:34 AM	0.20	78.60	9.63	46.73
27-Oct-94	06:35 AM	0.30	78.60	9.80	48.47
27-Oct-94	06:36 AM	0.22	76.98	9.83	49.23
27-Oct-94	06:37 AM	0.20	76.15	9.57	49.00
27-Oct-94	06:38 AM	0.27	76.35	9.70	48.27
27-Oct-94	06:39 AM	0.23	76.48	9.63	48.53
27-Oct-94	06:40 AM	0.33	76.48	9.50	47.50

Run 7

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
29-Oct-94	10:22 AM	0.08	98.93	12.50	47.83
29-Oct-94	10:23 AM	0.05	90.90	12.23	47.93
29-Oct-94	10:24 AM	0.05	88.95	12.33	47.97
29-Oct-94	10:25 AM	0.03	90.07	12.13	48.00
29-Oct-94	10:26 AM	0.07	92.35	11.93	47.73
29-Oct-94	10:27 AM	0.08	96.72	12.27	47.37
29-Oct-94	10:28 AM	0.05	100.52	11.70	47.70
29-Oct-94	10:29 AM	0.08	101.83	11.40	47.93
29-Oct-94	10:30 AM	0.05	101.53	11.33	47.87
29-Oct-94	10:31 AM	0.08	103.72	11.13	47.70
29-Oct-94	10:32 AM	0.10	105.30	11.40	48.03
29-Oct-94	10:33 AM	0.08	108.20	10.83	48.17
29-Oct-94	10:34 AM	0.08	109.75	10.97	48.50
29-Oct-94	10:35 AM	0.17	134.78	11.73	48.47
29-Oct-94	10:36 AM	0.13	130.48	10.73	48.40
29-Oct-94	10:37 AM	0.17	127.72	11.53	48.80
29-Oct-94	10:38 AM	0.27	164.52	14.37	48.43
29-Oct-94	10:39 AM	0.30	184.38	14.13	48.00
29-Oct-94	10:40 AM	0.23	154.98	13.00	48.00
29-Oct-94	10:41 AM	0.23	175.45	13.17	48.57
29-Oct-94	10:42 AM	0.23	185.20	12.47	48.80
29-Oct-94	10:43 AM	0.33	209.10	13.87	49.13
29-Oct-94	10:44 AM	0.33	219.47	12.70	49.50
29-Oct-94	10:45 AM	0.20	190.05	11.87	49.90
29-Oct-94	10:46 AM	0.12	160.38	11.37	49.50
29-Oct-94	10:47 AM	0.12	148.12	10.97	49.13
29-Oct-94	10:48 AM	0.18	151.12	11.27	48.77
29-Oct-94	10:49 AM	0.13	151.95	11.07	48.77
29-Oct-94	10:50 AM	0.12	141.78	10.83	48.37
29-Oct-94	10:51 AM	0.13	150.75	11.67	46.10
29-Oct-94	10:52 AM	0.17	167.03	11.30	47.67
29-Oct-94	10:53 AM	0.12	145.25	10.87	47.60
29-Oct-94	10:54 AM	0.15	140.48	11.10	47.70
29-Oct-94	10:55 AM	0.17	171.13	11.07	47.63
29-Oct-94	10:56 AM	0.13	154.23	10.43	48.50
29-Oct-94	10:57 AM	0.08	142.08	10.37	48.93
29-Oct-94	10:58 AM	0.10	137.50	10.10	49.93
29-Oct-94	10:59 AM	0.12	136.78	10.40	50.23
29-Oct-94	11:00 AM	0.15	152.75	10.30	50.93
29-Oct-94	11:01 AM	0.10	146.90	10.67	50.87
29-Oct-94	11:02 AM	0.12	157.62	10.33	50.67
29-Oct-94	11:03 AM	0.13	144.28	10.23	50.83
29-Oct-94	11:04 AM	0.08	137.78	10.90	50.07
29-Oct-94	11:05 AM	0.08	131.28	10.77	49.33
29-Oct-94	11:06 AM	0.17	162.17	11.57	48.83
29-Oct-94	11:07 AM	0.13	172.33	12.53	48.63
29-Oct-94	11:08 AM	0.23	206.42	11.80	48.87
29-Oct-94	11:09 AM	0.20	162.53	11.10	48.73
29-Oct-94	11:10 AM	0.13	149.93	10.60	48.60
29-Oct-94	11:11 AM	0.12	135.47	10.23	48.83
29-Oct-94	11:12 AM	0.15	135.13	10.27	48.87

Run 7 (continued)

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
29-Oct-94	11:13 AM	0.10	130.77	10.10	48.60
29-Oct-94	11:14 AM	0.13	157.03	11.63	48.47
29-Oct-94	11:15 AM	0.18	199.27	10.73	48.80
29-Oct-94	11:16 AM	0.10	160.85	10.10	48.83
29-Oct-94	11:17 AM	0.10	141.98	10.40	48.77
29-Oct-94	11:18 AM	0.18	192.67	11.17	48.90
29-Oct-94	11:19 AM	0.10	160.55	10.43	48.70
29-Oct-94	11:20 AM	0.10	166.97	10.93	48.90
29-Oct-94	11:21 AM	0.13	172.90	10.77	48.83
29-Oct-94	11:22 AM	0.10	164.18	10.53	48.77
29-Oct-94	11:23 AM	0.20	191.17	11.93	48.93
29-Oct-94	11:24 AM	0.12	167.00	10.90	49.07
29-Oct-94	11:25 AM	0.12	151.88	10.63	49.43
29-Oct-94	11:26 AM	0.13	194.98	11.93	49.47
29-Oct-94	11:27 AM	0.18	218.63	13.33	49.30
29-Oct-94	11:28 AM	0.42	316.78	13.97	48.30
29-Oct-94	11:29 AM	0.28	247.23	12.23	48.00
29-Oct-94	11:30 AM	0.17	196.00	10.50	48.60
29-Oct-94	11:31 AM	0.12	176.25	9.87	48.37
29-Oct-94	11:32 AM	0.10	160.83	10.20	47.43
29-Oct-94	11:33 AM	0.12	165.32	10.53	48.80
29-Oct-94	11:34 AM	0.13	194.78	10.83	49.33
29-Oct-94	11:35 AM	0.08	165.87	10.10	49.97
29-Oct-94	11:36 AM	0.10	170.32	10.07	50.60
29-Oct-94	11:37 AM	0.08	173.30	10.07	50.43
29-Oct-94	11:38 AM	0.13	199.18	10.73	50.43
29-Oct-94	11:39 AM	0.15	224.58	11.03	50.90
29-Oct-94	11:40 AM	0.12	186.73	9.63	50.83
29-Oct-94	11:41 AM	0.17	197.50	10.10	50.57
29-Oct-94	11:42 AM	0.10	170.97	9.33	50.03
29-Oct-94	11:43 AM	0.10	153.42	9.07	49.60
29-Oct-94	11:44 AM	0.07	140.73	9.13	49.47
29-Oct-94	11:45 AM	0.10	163.37	9.60	49.20
29-Oct-94	11:46 AM	0.10	149.73	9.27	49.17
29-Oct-94	11:47 AM	0.12	157.55	9.00	48.67
29-Oct-94	11:48 AM	0.10	143.77	8.87	48.67
29-Oct-94	11:49 AM	0.12	200.87	10.97	48.33
29-Oct-94	11:50 AM	0.23	224.62	10.00	48.20
29-Oct-94	11:51 AM	0.10	180.25	9.73	48.80
29-Oct-94	11:52 AM	0.10	153.18	9.63	50.40
29-Oct-94	11:53 AM	0.10	139.95	10.13	51.27
29-Oct-94	11:54 AM	0.18	192.30	10.37	52.30
29-Oct-94	11:55 AM	0.17	169.57	10.00	52.43
29-Oct-94	11:56 AM	0.10	152.05	9.57	52.03
29-Oct-94	11:57 AM	0.08	137.10	9.37	50.23
29-Oct-94	11:58 AM	0.10	149.92	9.27	49.80
29-Oct-94	11:59 AM	0.08	158.93	9.47	49.33
29-Oct-94	12:00 PM	0.10	157.53	9.23	48.90
29-Oct-94	12:01 PM	0.10	153.62	9.43	49.37
29-Oct-94	12:02 PM	0.10	160.22	9.73	50.37
29-Oct-94	12:03 PM	0.12	161.38	10.17	51.53

Run 7 (continued)

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
29-Oct-94	12:04 PM	0.23	233.52	11.93	51.23
29-Oct-94	12:05 PM	0.17	215.82	11.37	50.87
29-Oct-94	12:06 PM	0.18	185.85	9.97	50.60
29-Oct-94	12:07 PM	0.13	155.38	9.73	49.40
29-Oct-94	12:08 PM	0.15	160.82	10.23	49.30
29-Oct-94	12:09 PM	0.13	152.30	9.60	49.37
29-Oct-94	12:10 PM	0.10	144.03	9.67	49.40
29-Oct-94	12:11 PM	0.12	174.93	10.50	48.93
29-Oct-94	12:12 PM	0.18	174.63	10.17	48.97
29-Oct-94	12:13 PM	0.12	152.73	9.33	48.83
29-Oct-94	12:14 PM	0.10	140.57	9.73	49.07
29-Oct-94	12:15 PM	0.20	181.55	10.00	49.17
29-Oct-94	12:16 PM	0.13	194.78	9.93	49.43
29-Oct-94	12:17 PM	0.10	178.25	10.20	49.53
29-Oct-94	12:18 PM	0.12	183.08	10.43	49.57
29-Oct-94	12:19 PM	0.13	197.18	9.83	49.53
29-Oct-94	12:20 PM	0.12	168.48	9.73	49.70
29-Oct-94	12:21 PM	0.15	168.83	9.40	49.87
29-Oct-94	12:22 PM	0.15	164.30	9.93	48.77
29-Oct-94	12:23 PM	0.22	245.33	11.30	49.00
29-Oct-94	12:24 PM	0.17	227.62	9.93	49.20
29-Oct-94	12:25 PM	0.23	215.98	10.47	48.97
29-Oct-94	12:26 PM	0.15	186.70	10.27	49.33
29-Oct-94	12:27 PM	0.20	233.65	11.40	51.00
29-Oct-94	12:28 PM	0.17	184.03	10.50	52.00
29-Oct-94	12:29 PM	0.13	188.32	10.27	52.43
29-Oct-94	12:30 PM	0.15	170.47	10.70	52.23
29-Oct-94	12:31 PM	0.27	259.92	12.53	51.43
29-Oct-94	12:32 PM	0.30	308.48	11.97	49.80
29-Oct-94	12:33 PM	0.28	267.08	11.20	48.63
29-Oct-94	12:34 PM	0.22	214.67	10.67	47.70
29-Oct-94	12:35 PM	0.20	220.25	10.83	47.47
29-Oct-94	12:36 PM	0.22	194.83	10.53	47.90
29-Oct-94	12:37 PM	0.22	203.82	10.97	48.40
29-Oct-94	12:38 PM	0.25	225.12	11.63	47.40
29-Oct-94	12:39 PM	0.25	244.00	12.10	48.27
29-Oct-94	12:40 PM	0.22	234.85	10.70	48.90
29-Oct-94	12:41 PM	0.28	291.75	12.90	48.80
29-Oct-94	12:42 PM	0.28	278.18	11.30	47.87
29-Oct-94	12:43 PM	0.28	273.40	12.67	47.47
29-Oct-94	12:44 PM	0.33	281.53	10.47	47.17
29-Oct-94	12:45 PM	0.22	224.77	10.60	46.80
29-Oct-94	12:46 PM	0.18	214.73	10.37	47.40
29-Oct-94	12:47 PM	0.15	188.67	9.93	48.60
29-Oct-94	12:48 PM	0.17	211.80	10.33	49.40
29-Oct-94	12:49 PM	0.17	193.32	10.27	50.17
29-Oct-94	12:50 PM	0.13	194.48	10.37	50.50
29-Oct-94	12:51 PM	0.13	178.12	9.57	50.03
29-Oct-94	12:52 PM	0.10	148.58	9.30	48.60
29-Oct-94	12:53 PM	0.12	155.87	9.10	47.53
29-Oct-94	12:54 PM	0.10	148.57	9.07	47.13

Jn 7 (continued)

Date	Time	THC Value (ppm)	NOX Value (ppm)	CO Value (ppm)	SO2 Value (ppm
29-Oct-94	12:55 PM	0.13	139.57	8.93	46.87
29-Oct-94	12:56 PM	0.10	147.18	9.33	47.53
29-Oct-94	12:57 PM	0.15	151.53	9.40	49.40
29-Oct-94	12:58 PM	0.12	136.92	9.37	50.37
29-Oct-94	12:59 PM	0.10	131.27	9.47	50.83
29-Oct-94	01:00 PM	0.08	128.30	9.37	50.97
29-Oct-94	01:01 PM	0.08	125.25	9.00	50.43
29-Oct-94	01:02 PM	0.07	122.80	9.17	49.07
29-Oct-94	01:03 PM	0.08	139.10	8.83	48.00
29-Oct-94	01:04 PM	0.10	139.08	9.07	47.43
29-Oct-94	01:05 PM	0.10	127.97	8.53	47.13
29-Oct-94	01:06 PM	0.10	122.77	8.63	47.70
29-Oct-94	01:07 PM	0.12	122.20	8.73	48.53
29-Oct-94	01:08 PM	0.10	120.70	8.77	49.20
29-Oct-94	01:09 PM	0.10	123.47	8.90	49.87
29-Oct-94	01:10 PM	0.12	121.82	8.83	50.07
29-Oct-94	01:11 PM	0.08	116.77	8.77	49.70
29-Oct-94	01:12 PM	0.10	114.97	8.60	48.87
29-Oct-94	01:13 PM	0.10	114.68	8.80	48.90
29-Oct-94	01:14 PM	0.13	132.82	9.10	48.43
29-Oct-94	01:15 PM	0.12	121.82	8.77	48.13
29-Oct-94	01:16 PM	0.05	115.65	8.77	47.90
29-Oct-94	01:17 PM	0.03	113.03	8.60	47.67
29-Oct-94	01:18 PM	0.03	112.30	8.70	48.47
29-Oct-94	01:19 PM	0.08	114.67	8.83	49.13
29-Oct-94	01:20 PM	0.12	136.80	9.17	49.03
29-Oct-94	01:21 PM	0.10	124.12	8.93	48.80
29-Oct-94	01:22 PM	0.15	142.62	9.23	48.83
29-Oct-94	01:23 PM	0.13	125.83	9.03	48.90
29-Oct-94	01:24 PM	0.18	113.52	8.87	48.43
29-Oct-94	01:25 PM	0.18	113.08	8.87	48.20
29-Oct-94	01:26 PM	0.13	115.63	8.73	48.57

APPENDIX S

METALS DATA SUMMARY

TABLE S-1. METALS EMISSIONS SUMMARY

DATE		RUN 2 10/21/94	RUN 4 10/24/94	RUN 6 10/27/94
FEED DATA				
Average Batch Feed				
175mm COMP B Proj	(No.)	480	480	480
	(lb/ea)	115	115	115
	(tons)*	27.6	27.6	27.6
STACK GAS DATA				
Volumetric Flow Rate (dscf/hr)		233766	202153	215519
SAMPLING EQUIPMENT DATA				
Dry Gas Volume (dscf)		32.90	33.81	37.66
Total Sampling Time (min)		60	72	72
Isokinetic Sampling Rate (%)		104.53	103.51	105.49
EMISSION DATA				
Max Ag Emission Rate (g/hr)		0.00146	0.00062	0.01272
Max As Emission Rate (g/hr)		0.00772	0.00192	0.00085
Max Ba Emission Rate (g/hr)		0.03398	0.03972	0.01611
Max Be Emission Rate (g/hr)		0.00036	0.00030	0.00029
Max Cd Emission Rate (g/hr)		0.05378	0.02240	0.00869
Max Cr Emission Rate (g/hr)		0.04243	0.24067	0.14823
Max Ni Emission Rate (g/hr)		0.04441	0.42284	0.20247
Max Pb Emission Rate (g/hr)		0.07737	0.07593	0.02878
Max Sb Emission Rate (g/hr)		0.00229	0.00090	0.00038
Max Se Emission Rate (g/hr)		0.00071	0.00060	0.00057
Max Tl Emission Rate (g/hr)		0.00071	0.00030	0.00029

* Batch feed rate exceeds previous limit of 25 tons.

EMISSION RATE CALCULATIONS
(Run 2)

1. Ag Emission Rate: M_{Ag} = 0.21 ug

$$W_{Ag} = \frac{0.21 * 233766}{32.9 * 1{,}000{,}000 \text{ ug/g}}$$

$$= 0.00146 \text{ g/hr}$$

2. As Emission Rate: M_{As} = 1.09 ug

$$W_{As} = \frac{1.09 * 233766}{32.9 * 1{,}000{,}000 \text{ ug/g}}$$

$$= 0.00772 \text{ g/hr}$$

3. Ba Emission Rate: M_{Ba} = 4.78 ug

$$W_{Ba} = \frac{4.78 * 233766}{32.9 * 1{,}000{,}000 \text{ ug/g}}$$

$$= 0.03398 \text{ g/hr}$$

4. Be Emission Rate: M_{Be} = 0.05 ug

$$W_{Be} = \frac{0.05 * 233766}{32.9 * 1{,}000{,}000 \text{ ug/g}}$$

$$= 0.00036 \text{ g/hr}$$

5. Cd Emission Rate: M_{Cd} = 7.57 ug

$$W_{Cd} = \frac{7.57 * 233766}{32.9 * 1{,}000{,}000 \text{ ug/g}}$$

$$= 0.05378 \text{ g/hr}$$

6. Cr Emission Rate: M_{Cr} = 5.97 ug

$$W_{Cr} = \frac{5.97 * 233766}{32.9 * 1{,}000{,}000 \text{ ug/g}}$$

$$= 0.04243 \text{ g/hr}$$

7. Ni Emission Rate: M_{Ni} = 6.25 ug

$$W_{Ni} = \frac{6.25 * 233766}{32.9 * 1{,}000{,}000 \text{ ug/g}}$$

$$= 0.04441 \text{ g/hr}$$

8. Pb Emission Rate: M_{Pb} = 10.89 ug

$$W_{Pb} = \frac{10.89 * 233766}{32.9 * 1{,}000{,}000 \text{ ug/g}}$$

$$= 0.07737 \text{ g/hr}$$

9. Sb Emission Rate: M_{Sb} = 0.32 ug

$$W_{Sb} = \frac{0.32 * 233766}{32.9 * 1{,}000{,}000 \text{ ug/g}}$$

$$= 0.00229 \text{ g/hr}$$

10. Se Emission Rate: M_{Se} = 0.10 ug

$$W_{Se} = \frac{0.10 * 233766}{32.9 * 1{,}000{,}000 \text{ ug/g}}$$

$$= 0.00071 \text{ g/hr}$$

11. Tl Emission Rate: M_{Tl} = 0.10 ug

$$W_{Tl} = \frac{0.10 * 233766}{32.9 * 1{,}000{,}000 \text{ ug/g}}$$

$$= 0.00071 \text{ g/hr}$$